ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXI, No. 5. CHICAGO, SATURDAY, AUGUST 3, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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THE FRAGILITY OF METAL FILAMENTS.

The frequency with which lamps with tungsten filaments were fractured in the early days of that type of lamp militated somewhat against its general adoption and proved a source of general annoyance and dissatisfaction. This property was especially pronounced in the original extruded filaments, which were formed from a paste and afterwards heated to a high temperature so as to drive out the binding material and sinter the particles of the metal together. This method of manufacture left the filament in a highly crystalline state and it was this crystalline nature which gave the metal its fragile quality.

The advent of the filament of drawn wire greatly improved the initial condition of the tungsten lamp, since this form of tungsten was ductile in its nature and possessed of much higher strength, due to the fact that it did not have the crystalline texture of the old-style filaments. If this initial condition of the metal could be indefinitely maintained, it is probable that the filament would never become fragile, since fragility has been shown to depend upon the extent to which crystallization has taken place in the material. Unfortunately, however, the drawn-wire filament does not indefinitely retain the properties which it possesses immediately after passing through the die. With continued use the metal reverts into a crystalline condition, and might eventually acquire the same fragility which is inherent in the extruded filament.

This change in the structure of the metal is probably hastened by its continued maintenance at a high temperature. It is well known that a high temperature makes molecular changes in any substance proceed with greater facility, and if there is an inherent tendency in the metal towards crystallization the change will take place more rapidly when it is maintained at a high temperature than it would at ordinary temperature. The rate at which crystallization takes place depends not only upon temperature, but also upon other conditions such as vibration and the presence in the surrounding atmosphere of agents which appear to have a catalytic action. Thus, in an atmosphere of nitrogen the filament will become crystallized much more rapidly than in a high vacuum or in an atmosphere of carbon dioxide.

One great advantage of the drawn-wire filament is that the nuclei of crystallization are probably quite small and consequently a slower deterioration and a

longer life seem to be added to its initial strength and ruggedness. Moreover, the points of greatest stress are the points of support, and owing to the rapid conduction of heat, these points do not reach the high temperature of the main portion of the filament, and hence do not crystallize to any great extent. The strength of the filament is thus conserved at the points where it is most needed, and even though parts of the filament become crystalline, the resistance to breakage will remain greater than that of a pressed filament for an indefinite period. Thus fracture is not likely to take place even though the main portion of the filament may become fragile. But this condition is not reached until after long hours of burning, and every effort of the manufacturer is directed towards producing a condition of the metal which will retard this development.

At the recent convention of the National Electric Light Association it was announced that 10-watt lamps can now be made for the usual voltages, having properties equal to the lamps of larger size which are giving satisfactory performance at the present time. Greater perfection in manufacture is not only thus giving us a larger range of sizes in the tungsten lamp, but is facilitating manufacture so that a steady decrease in the price may be confidently expected, with the probable result that all other types of incandescent lamp will ultimately be driven from the field.

ELECTRIFICATION AT BOSTON.

The announcement by the New York, New Haven & Hartford Railroad a few days ago that it will proceed as soon as possible to electrify and four-track its main line between Boston, Mass., and Providence, R. I., is welcome news to advocates of electrical service for terminal and interurban transportation. Engineers and draftsmen are actively at work upon the plans for this important project, which will cost upwards of $7,000,000, and constitute a vital link in the Boston-New York electrified service. The distance involved is about 44 miles, and with about 75 miles of main line electrically operated between New York and New Haven, it is apparent that the time is not far distant when the steam locomotive will be ousted from the railroad service between the two great cities named.

The success of single-phase traction between Woodlawn and Stamford, and the elimination of most of the difficulties which arose on the New York division of the New Haven, naturally leads to the adoption of similar equipment for the Boston service. From the first, the single-phase system has clearly been adapted to extension over great distances for trunk-line operation, and it is not too much to say that the success of the Boston work is almost entirely a matter of dollars and cents today, and not one of engineering detail. Out of the electrification to Providence will doubtless come in due time the elimination of steam as a motive power in all the railroad service of Boston.

THE CALIFORNIA PUBLIC-UTILITY ACT.

We called attention in these columns last week to some of the striking differences of the public-utility acts of Wisconsin and Ohio. In this connection it may be interesting to compare also the provisions of the public-utility act which went into effect in California this year with the Wisconsin law.

California constitutes another one of the states which has omitted the provision for indeterminate franchises. In both California and Ohio the lodgement of power in the Commission to grant franchises of this character was prevented by the provision of the law granting municipalities control in this matter. In both states home rule in the granting of rights to a public-utility company seems to have been considered more important than a uniform franchise provision. In California home rule is contained in the state constitution, so that it was impossible to change this by legislative act. The act provides that municipalities may surrender their powers in this regard to the Commission by a majority popular vote, but this act may be rescinded at any time by a similar vote and control taken again into the hands of the municipality. The latter greatly weakens the safeguards which would otherwise be placed around the operation of public utilities, for if a municipality is dissatisfied with a ruling of the Commission it may take matters into its own hands to be decided locally.

The California act makes no provision for acquisition by a municipality of an existing utility. In Wisconsin a municipality has this power and there is a provision for a valuation of the property by the Commission in order to determine the price to be paid by the municipality.

In Wisconsin the Railroad Commission not only has control of the rates of public-utility companies but also has jurisdiction over those of municipally operated plants. In California since the municipality is supreme in its own field there is no outside regulation of municipal plants and there is no protection to a private company from municipal competition.

In California information furnished to the Commission by a utility is regarded as confidential and is only made public by an express order of the Commission. In Wisconsin all facts and information in the possession of the Commission are open to the public for inspection.

Many of the provisions in both states are of course similar, including the control of the issuing of securities, the prevention of discrimination and exorbitant rates, and appeal to the state courts from decisions of the Commission.

This comparison serves to indicate once again that the Wisconsin act may well be taken as a model for other states to follow, since where its provisions differ from those of other states it seems to have taken the wiser course. The utility companies in Wisconsin certainly occupy a stronger position and greater protection is provided for conserving their rights. From the standpoint of the consumer there is certainly no dis-

advantage in the Wisconsin provisions and his protection is at least as great, if not greater, than in the other two states here considered.

THE ENGINEER IN CIVIC AFFAIRS.

The development of government in this country has been largely such as to throw not only the administration of public affairs but largely also the consideration of the steps necessary for the public welfare into the hands of a class of professional politicians. Of late years, however, there has been a very noticeable tendency away from this condition and public-spirited citizens in all walks of life have been concerning themselves more and more with the activities, both of local and general governments. The engineer is one who should naturally from his training take an active interest in public affairs and more especially in those matters which involve the planning, erection and operation of public works. Not only his knowledge of construction work but his general point of view enables him to give a more critical and detailed consideration to matters of this kind.

It is not, however, only in this capacity as a citizen that the engineer should have interest in government, and especially municipal administration. The problems concerning the municipality have come to be largely of two classes, those involving merely business operations and those involving work which more properly should be classed as engineering. Proper administration of a city's affairs requires, consequently, not only capable engineers in the subordinate positions which deal with the immediate carrying out of the work, but also in the higher administrative positions which are to be responsible for the entire conduct of affairs. In Germany this has been so fully recognized that there is a demand for engineers to fill the highest municipal administrative offices, corresponding to that of mayor in this country. In Germany this position is not one which is confined to local residents, but the best man who can be obtained for the position is called from another city if necessary, and the work of a mayor is regarded as a definite and regular occupation. Men entering upon this field of activity make a career of it, success usually meaning a call to larger and larger cities, where the responsibility and work to be done are increasing. The demand for men of engineering ability to fill such an office is but an indication of the trend of the times in municipal affairs.

The fact that engineering ability and knowledge are regarded as desirable qualifications for such an office points to the conclusion that it is incumbent upon engineers to take an active interest in government administration, especially in cities, and to see to it that an intelligent public opinion is cultivated upon those engineering questions with which municipal administration is concerned. Only by keeping in touch with developments in this line and by holding definite opinions which have been formed through deliberate consideration of the matters involved, will it be possible for the engineer to exert that influence and occupy that position which are properly his. Associations of engineers should stand ready in every municipality to offer advice and criticism in the proposing of names for municipal positions and in passing upon the adequacy of contemplated public works.

WIRING DIAGRAMS FOR PURCHASERS.

It is doubtful if anything does more to facilitate the proper and convenient use of complex electrical apparatus by its purchaser, actual or prospective, than the practice of supplying wiring diagrams with the equipment when it is placed in service. Yet this excellent policy is often deprived of its greatest value by the failure of manufacturers to include with such diagrams clear and logical explanations of their significance. There are of course many instances where the circuit diagram is simple and plain enough to require no accompanying printed explanation, but even here it is important not to overlook the value of accurately labelling all symbolic parts, numbering terminals and designating wires so that there can be no possible excuse for a misunderstanding. Few people realize the extent to which an apparently trifling misconnection in an auxiliary piece of apparatus may upset the performance of a high-powered and costly generating unit, motor or transforming device, but it is an undeniable fact that safe and efficient operation are both functions of extreme accuracy in the establishment of wiring connections.

A typical instance is afforded by a company which is installing an improved electric railway signal for trial purposes upon a number of traction systems in different parts of the country. With each consignment of signals from the factory, blueprints of the wiring are given to the operating officials interested, with an attractively printed folder giving a brief description of the apparatus, and a complete exposition in simple English of the working of each circuit and detail of the mechanism under every service condition which can be anticipated. Every step in the performance of the apparatus is set forth in terms which cannot be misunderstood by any wireman or shop employee competent to attach a conductor to a binding post; nothing is left to the imagination, and all the materials are provided for the quickest possible detection of trouble and its remedy under the pressing conditions of actual operation. Such a booklet goes a long way beyond the ordinary printed installation card or instruction leaflet supplied with intricate apparatus. It facilitates the memorizing of connections to a remarkable degree and saves the purchaser real money otherwise expended for high-priced labor during the attempts of the latter grade of employees to remember the significance of the wiring diagram itself. In its way, it is as complete as a set of patent specifications, and in its logical arrangement, readability and value to the signal maintainer it meets a want often unsupplied in other fields of electrical service.

National Electric Light Association.

At the meeting of the Executive Committee of the National Electric Light Association at New York, July 24, Secretary T. C. Martin presented a report showing a net membership of 12,185 as of July 24. A total of 1,041 members was admitted at the meeting.

The Pacific Gas & Electric Company, San Francisco, has been authorized to form a company section.

The affairs of the Commercial Section were given considerable attention, Chairman E. W. Lloyd outlining its condition, plans and work. In view of the issuance of the Commercial Digest by the Section, and its overlapping with the Solicitors' Handbook, it was decided to merge the two publications in the hands of the Section. The Digest is issued in loose-leaf form, and is easily, therefore, kept up to date. It goes to all members of the Section, which also is now planning three or four new publications to be issued this year.

President Tait announced that the *Question Box* of the *Bulletin*, hitherto conducted by editors in the offices of various member companies, had now been taken into the office of the Association, where the work would now be done, the July issue being the last to be handled by Mr. Edkins. The new work will begin with the August-September issue.

Picnic of Springfield Utilities.

The employees of the utilities in Springfield, Ill., combined to hold a general basket picnic at Washington Park on July 19. The Springfield Light, Heat & Power Company, the Springfield Consolidated Railway Company and the Springfield Gas Light Company were all included. A large number of visitors from other cities were also present. The day's festivities were opened by an address by A. A. Anderson, general manager of the consolidated utilities. This was followed by a short address by W. J. Fitzgerald.

Athletic contests were held, for which prizes were given, the final event being a baseball game between teams representing the railway company and the gas company. The latter won by a score of 7 to 4. Alex Long captained the railway team. In the evening there was a balloon ascension and dancing.

New Wireless Regulation.

A 24-hour vigil in the wireless room of every ocean-going vessel clearing from an American port, with 50 or more persons aboard, is provided in a bill agreed upon by the Senate and House of Representatives.

On cargo-carrying vessels, one first-class operator would be required, but another member of the crew would be required to understand the transmission of distress signals. The bill is one of several due to the *Titanic* disaster.

Chicago Electrolysis Ordinance.

The problem of electrolysis of underground pipes by stray electrical currents has been attracting attention in Chicago for some time, as serious leaks in the water pipes have been shown to be due to it. The City Council on July 15 passed an ordinance which is intended to prevent a continuation of past conditions. It is entitled "An Ordinance Requiring Certain Electrical Equipment in Order to Prevent Damage by Electrolysis," and reads as follows:

AN ORDINANCE

Be it ordained by the City Council of the City of Chicago:

SECTION 1. All uninsulated electrical return circuits must be of such current-carrying capacity and so arranged that the difference of potential between any two points on the return will not exceed the limit of twelve volts and between any two points on the return 1,000 feet apart within one mile radius of the City Hall will not exceed the limit of one volt, and between any two points on the return 700 feet apart outside of this one-mile-radius limit will not exceed the limit of one volt. In addition thereto a proper return-conductor system must be so installed and maintained as to protect all metallic work from electrolysis damage.

The return-current amperage on pipes and cable sheaths must not be greater than 0.5 ampere per pound-foot for caulked cast-iron pipe; 8 amperes per pound-foot for screwed wrought-iron pipe and 16 amperes per pound-foot for standard lead or lead-alloy sheaths of cables.

SECTION 2. All persons, firms or corporations operating railways must equip their uninsulated return-current systems in the following manner:

First: With insulated pilot-wire circuits and voltmeters so that accurate chart records will be obtained daily showing the difference of potential between the negative busbars in each station and at least four extreme limits on the return circuit in its corresponding feeding district.

Second: With recording ammeters, insulated cables and automatic reverse-load and overload circuit-breakers which will record and limit the maximum amperes drained from all the metallic work (except the regular return feeders) to less than ten per cent of the total output of the station.

The said chart records must be so kept as to be always accessible to city officials.

SECTION 3. Any person, firm or corporation failing to comply with the provisions of this ordinance after nine months from the date of its passage shall be fined not less than $50 nor more than $200 for each offense; and each day's operation of such equipment contrary to said provisions shall constitute and be regarded as a separate and distinct offense.

SECTION 4. The last eight lines of paragraph 12 of section 862 of the Chicago Code of 1911, said eight lines appearing on page 303 of the official edition of said Code, are hereby repealed.

SECTION 5. This ordinance shall take effect and be in force from and after its passage and due publication.

The "Point Fives" Dine in London.

A sign of the times in connection with electricity supply work in England is the formation of a new circle of engineers with the title "The Point Fives." Only those are admitted who have adopted in their areas a charge of 0.5 pence per kilowatt-hour for electricity sold for domestic purposes. J. Horace Bowden, of Poplar, who was the first engineer to adopt so low a domestic rate as long ago as 1909, is the first chairman, and he presided over the first meeting of the charmed progressive circle which followed dinner served at Pagani's Restaurant, London, on the evening of Saturday, July 15. Only seven were present, but progressive spirit in electricity supply should shortly increase the number of the eligible. The next chairman following in order of adoption of the low charge mentioned, is H. F. Street, of Southampton, who will preside at the next meeting in December. Either municipal or company men are eligible provided their charge for domestic cooking, or cooking and heating, brings them within the title. A. Hugh Seabrook, of Marylebone, is secretary. Informal dinners and equally informal discussions on such matters as tariffs, design of cooking apparatus, maintenance and living questions, and interchange of experiences up-to-date—these form the program of this, at present, very small circle of central station men whose influence upon the future charges for domestic service may be far in excess of their numerical strength.

Power for Louisville.

The Louisville Lighting Company, of Louisville, Ky., has presented informally a proposal to directors of the Louisville Railway Company to furnish current for the operation of its lines. President George H. Harries, representing the electric company, has expressed his belief that a sufficiently low rate can be made to justify the traction company discontinuing the manufacture of its own power. He proposes to take over the new power plant of the Louisville Railway Company, now in course of erection, at a satisfactory figure. T. J. Minary, president of the Louisville Railway Company, stated that no proposition which can be given attention has yet been received by the company. It is understood that engineers will shortly be brought to Louisville to study the situation and secure data upon which a proposition will be based. It is likely that power, if the deal goes through, will be furnished from one of the Tennessee hydroelectric plants controlled by H. M. Byllesby & Company, owner of the Louisville Lighting Company.

Program of the Georgia Convention.

The second annual convention of the Georgia Section of the National Electric Light Association will be held at Tybee, Ga., on August 15, 16 and 17. Tybee is near Savannah and those attending the convention will meet in Savannah on Thursday morning and breakfast together at the De Soto Hotel and then take the train to Tybee. Convention headquarters will be at the New Tybee Hotel.

The first session will be held on Thursday at 2 p. m., when the address of the president will be delivered and there will be papers by A. N. Bentley on "Electric Vehicles in the Southeastern States," and by H. E. Bussey on "Synchronous Condensers." The evening will be devoted to a boat ride.

On Friday morning the following papers will be presented: "A Mechanical Collector, Its Offenses and Defenses," by Thomas W. Peters; "Arc Lamps and the More Recent Development Thereof," by L. A. S. Wood; "Buying Coal on a Heat-Unit Basis," by H. L. Sperry. In the afternoon there will be a visit to Fort Screven. In the evening there will be a session in the roof garden at which the report of the Public Policy Committee will be presented by P. S. Arkwright, and G. S. Merrill will present a paper entitled "Electric Rates."

At the session on Saturday morning W. L. Southwell will present a paper entitled "Diversity-Factor." This will be followed by an executive session. In the afternoon there will be an automobile ride and a visit to the new power station. At supper the members of the section will be the guests of the manufacturers.

Special entertainment features are promised for the ladies, who will be very cordially welcomed to the convention.

Exports of Copper.

Copper exports for the week ended July 25 totaled 5,181 tons; since July 1, 22,553 tons; same period last year, 32,135 tons.

Congress of Radiology.

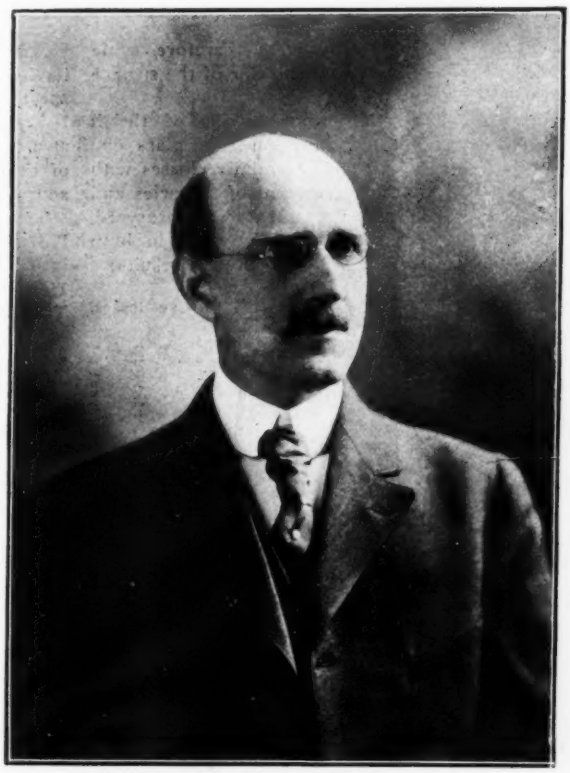
The sixth International Congress of Electrology and Radiology took place in Prague, Austro-Hungary, July 26 to 31.

John Price Jackson.

John Price Jackson, electrical engineer, educator and author, was born in Philadelphia, Pa., September 27, 1868; the son of Professor Josiah and Mary Detweiler (Price) Jackson.

He received his early education at the Taylor School, Kennett Square, Pa., and at the Pennsylvania State College. From the latter he received the degrees of Bachelor of Science, Electrical Engineer and Mechanical Engineer.

He was a director of the Industrial Department of Fish University, Nashville, Tenn., from 1889 to 1890; electrical engineer with the Sprague and Edison electrical companies in 1890 and 1892. He was professor of the electrical department from 1893 to 1907 and dean of the School of Engineering since 1907 at the Pennsylvania State College. He was president of the Pennsylvania Zinc Mining & Milling Company, of Grandy, Mo., and of the Nittany Light, Heat & Power Company. In 1904 he was a member of the jury on electricity of the St. Louis Exposition. He is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, Society for the Promotion of Engineering Education, and is Chairman of the Convention section of the Pennsylvania Society of Engineers. He is the joint author of "Alternating Currents and Alternating-Current Machinery," "Electricity and Magnetism," "Alternating-Current Phenomena," and he has contributed to a great many scientific transactions and periodicals. He also devoted considerable time to consulting work, and has taken part in the planning and designing of various engineering undertakings.



John Price Jackson,
Professor of Electrical Engineering, Pennsylvania State College.

Large Installation of Street-series Tungsten Lamps in Chicago.

An installation of 5,058 street-series tungsten lamps is to be substituted for gas lamps now used in lighting the streets of a large section in the north side of Chicago. The old gas lamp-posts will be remodeled so as to adapt them to tungsten lamps, which will be installed in 80-watt, single-lamp units. These units will be spaced 150 feet apart on each side of the street, the posts being staggered, and there will be two lamps at each intersection of two streets. These two will be placed at diagonally opposite street corners. It was originally intended to light this neighborhood with flaming arc lamps, but it was recently decided to use tungsten lamps instead.

Meeting of Wisconsin Contractors.

A meeting of the Electrical Contractors' Association of Wisconsin will be held on August 15, 16 and 17. Members and their ladies will assemble at Oshkosh on Wednesday evening, August 14. Early the next morning a chartered steamer will be boarded for Gill's Landing, from whence a train will carry the party to Waupaca, arriving at Chain-of-Lakes about 5 p. m.

Albert Petermann, 66 Cawker Building, Milwaukee, Wis., is secretary of the Association.

Wireless Stations for British Colonies.

An agreement has been reached by the British Postmaster-General and the Marconi Company for the immediate erection of wireless stations in Egypt, Aden, Bangalore, Pretoria and Singapore. These will all be high-power stations having a radius of 2,000 miles. They will be operated by the Marconi Company for the first six months and thereafter by the Government. The cost of each station will be $300,000 exclusive of land and buildings.

Boston Terminal to Be Electrified.

The Boston & Providence Railroad will be electrified and four-tracked at a cost of between $6,500,000 and $7,000,000, according to a decision of the New York, New Haven & Hartford management. It will be the first piece of electrification of a steam road running out of Boston.

The electrification and four-tracking will be completed before the end of 1913, officials announce. The entire electrification will be overhead trolley and single-phase alternating current. One great power house to supply the current for running both south and north-bound trains will be put up at Providence. Two additional tracks will be laid and all grade crossings eliminated on the whole division. The two-mile incline at Sharon Hill, which exceeds 3 per cent, will be reduced.

The issue of a maximum of $8,000,000 4.5-per-cent, 75-year bonds was authorized by the last Massachusetts Legislature to be sold subject to approval of the Massachusetts Railroad Commission. This bond issue will be secured by a mortgage which will also cover the $2,170,000 outstanding bonds of the Providence road. It will be guaranteed, principal and interest, by the New Haven, which will make a small annual sinking-fund contribution to cancel the issue shortly before expiration of the Providence lease in 1987.

Half Year in Copper Production.

Approximately 595,000,000 pounds of copper were produced by mines of United States, Mexico and Canada reporting to the Boston News Bureau during the first half of 1912. This was a record tonnage for a like period and compares with 502,000,000 pounds a year ago and 515,000,000 during the first six months of 1910.

In addition there were imported into the United States to be refined 129,000,000 pounds, making total copper available for treatment from these two sources in United States refineries during the period 724,641,470 pounds, against 617,426,627 pounds and 634,851,467 pounds in 1911 and 1910, respectively.

New Bids for Chilean Railway Electrification Sought.

The Chilean Government has decided not to accept the bids offered by the Société Anonyme Westinghouse, the Siemens-Schuckert Werke, and the Deutsche Bank of Berlin, for electrification of the Government Railway from Valparaiso to Santiago, and has appointed a new committee of engineers to draw up a new proposition and bids for this electrification will be asked for again.

Surface Leakage with Alternating Current.

At a recent meeting of the Physical Society of London an account of some "Surface Leakage Experiments with Alternating Currents" was given by G. L. Addenbrooke.

Experiments on dielectrics at different temperatures and over a wide range of periodicity, showed that the losses found were in some cases partly due to surface leakage. When this was eliminated, and the data obtained with the surface leakage and without were compared, it did not seem as if the portion of the losses due to surface leakage could be accounted for by assuming that it was constant at all periodicities, as in the case with the losses in metallic conduction.

Measurements were, therefore, made to ascertain the behavior of the surface leakage alone.

For this purpose strips of tinfoil were pasted on a sheet of glass one inch apart, and the relative losses with an alternating current of 42 cycles and a continuous current were measured, the pressure being the same in both cases. The following are the results:

State of Film on Glass.	Relative losses. Resistance in megohms	Continuous	Alternating
Ordinary day	300	1	3
Drier day	570	1	4
Film dried first in sun and cooled	770	1	5
Another glass surface	50,000	1	15

The power-factor was high in all cases.

Ebonite.—Similar experiments showed a much higher ratio for the losses—namely, 1 : 40.

Porcelain Insulators.—The ratio in this case was as high as 1 : 60 on a dry day, but part of this leakage may be through the material.

The relative leakages between the primary and secondary of a small induction coil and a small transformer were respectively 1 : 4.5 and 1 : 8. In these cases, also, the leakage was doubtless partly through the insulation.

Further experiments described show that the moisture present must be in a very attenuated state for the differences in the losses found to become sensible. Ordinary water, even in very thin films, does not show the effect.

The striking similarity between the above results and results obtained by measurements made of these losses through dielectrics are pointed out. The suggestion seems warranted that in both cases the effects may be due to the same fundamental cause, *viz.*, the presence of a very dilute electrolyte.

Improvements in Steam Boilers.

The United States Bureau of Mines makes the statement in a bulletin just issued that the present steaming capacities of steam boilers can be tripled or quadrupled by forcing over the heating surfaces three or four times the weight of gases now passed over them.

"With well-designed mechanical-draft apparatus this greater weight of gases can be forced through the boilers at small operating cost," the bulletin states. "It is possible to increase the capacity of many of the present boilers in this way without reducing their efficiency much; in fact by proper arrangment of the heating surfaces the efficiency can be made higher than at the present rating. The efficiency of any boiler can be increased by arranging its heating surfaces in series with respect to the path of hot gases. New boilers of high efficiency can be constructed by making the cross-section of the gas passages small in comparison with the length."

These statements are contained in Bulletin 18, "The Transmission of Heat into Steam Boilers," the authors being Henry Kreisinger and Walter T. Ray. The investigation of the transmission of heat into steam boilers is one of several researches now being carried on by the Bureau of Mines that have for their object the testing of methods by which the mineral fuels in this country may be used more efficiently. A better understanding of the laws governing heat transmission into boilers will result in the design of more efficient boilers, and more efficient boilers will reduce waste in the use of fuel.

The bulletin contains the following:

"The principles governing the combustion of fuel in boiler furnaces and the absorption of heat by boilers have been little understood. The dogmas that the area of grate should have a certain ratio to the area of the heating surface, and that it takes 10 square feet of heating surface to make one boiler horsepower, seemingly had become so thoroughly fixed in the mind that they were hardly ever questioned. It is only within the last decade that a few engineers have broken away from the old rule-of-thumb methods and have begun to investigate the functions of the boiler and furnace separately. Their studies seem to mark the beginning of advance in steam-generating apparatus."

Electric Car for Glidden Pathfinder.

An interesting feature of this year's Glidden automobile tour is the fact that an electric car has been chosen as pathfinder. The choice has fallen upon the Flanders electric.

Electricity in Smoked-Meat Plants.

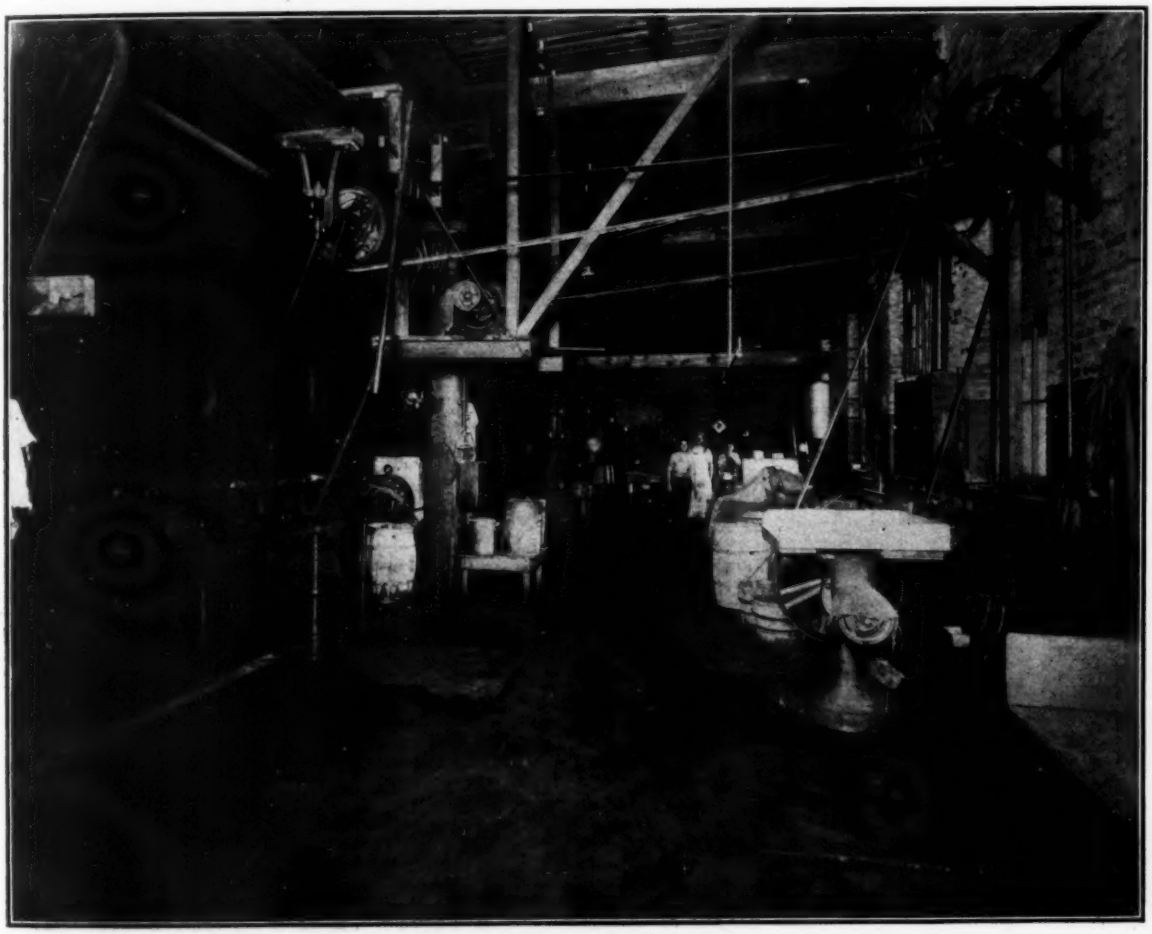
Due to the long hours of use, varying loads, and the necessity for cleanliness and uninterrupted operation, electric motor drive with central-station power should find a wide application in smoked-meat plants. This article deals particularly with sausage grinding, discussing some of the important points in connection with the adoption of electric drive. Data are given on typical installations.

It is almost universally true that the engineering in most packing houses, or plants devoted to the manufacture of sausage, is looked upon as a necessary nuisance and expense. In fact, it would appear to be so considered in most industrial establishments, except those wherein the character of the work of manufacture is largely of an engineering nature, and therefore entered into and understood by those financially interested. It is, moreover, too frequently true that much of the so-called engineering is not what it should be, is needlessly expensive and not productive of the best results. Regardless of reduction in power bills, therefore, central-station power should find a wide application in this field and at the same time, the manufacturer will have greatly improved his power conditions.

The consideration of electric power for use in sausage-manufacturing plants brings to the central-station engineer many of the same problems which come to him for solution when its use is under consideration for other kinds of industrial establishments. It may be said in general, however, that the conditions in many ways are more trying than in almost any other class of service. It does not require such great refinement as is necessary in other lines of manufacture, but a system of power distribution, to be suitable for a sausage plant, must be thoroughly reliable.

The saving which can be effected by the use of electricity for power purposes varies greatly with different plants and depends, of course, on the size and arrangement of the plant under consideration. A thorough canvass of the plant should be made and the present as well as the possible future conditions carefully weighed. Any comparison of economies should embrace not only the saving in fuel but should also include the relative costs of repairs and maintenance for the two systems.

Of the plants now operating with mechanical transmission, the larger ones and those most complex or widely scattered would naturally derive the greatest benefit by adopting central-station power. In such plants, the transmission is usually more complicated, changing floor loads make it more difficult to keep shafting in



Group of Motor-Driven Sausage Machines in Plant of the Standard Sausage Company.

line, while developing conditions make frequent modifications and extensions to the transmission equipment necessary. To save time and expense, these changes are often knowingly made, not in a manner to get the most economical results, but in a way that will do for the time and avoid interruptions to business. In a sausage plant it is essential that things be kept moving, and frequently unfortunate compromises are made in the machinery arrangements to accomplish this end.

It is a common occurrence that not all the departments of a sausage plant are operated continuously or simultaneously, therefore, in plants using mechanical drive it is necessary to operate the entire engine equipment if it is only desired to run one or two machines. A carefully determined and suitable arrangement of electric motors permits any or all departments to be operated at will, without the loss due to operating needless transmission equipment.

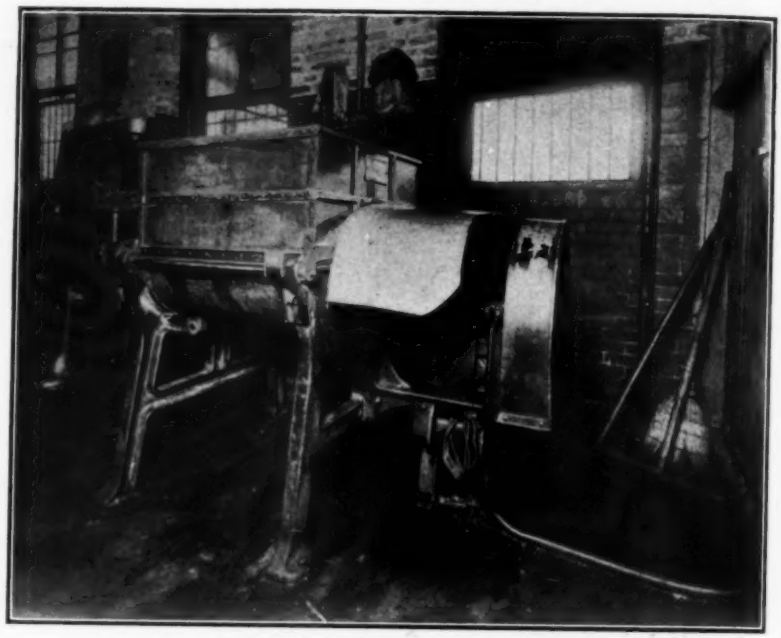
In a prosperous concern some departments develop, perhaps even reaching such proportions that it may become necessary to re-locate them. Another department shrinks or may be found to occupy space which could be used to better advantage for some other purpose. It is often found awkward to arrange anything like a good and economical plan for distributing power with shafting and belting, and departments are frequently, therefore, necessarily kept in awkward relations on this account, it being too expensive to re-locate them. With mechanical transmission it sometimes happens that the location of the power plant is a compromise or make-shift arrangement, brought about by the necessity of getting at the main lines of shafting. It may occupy space which could and naturally would be used to good advantage for productive purposes. The elimination of the innumerable belts inseparable from mechanical drive also increases safety to operatives, eliminates dirt, which is of paramount importance in plants manufacturing food products, and in addition greatly improves lighting conditions.

With motors, if group drive is adopted, belt speeds are usually higher and the belts consequently smaller. The motors are placed on ceilings, walls or floors as may be most convenient, and drive in any direction, thus permitting arrangements to be made which are best suited to the various conditions. The controlling switches should be placed convenient for use in starting or more especially in stopping, should accident occur which requires prompt action in shutting down the machinery. At the same time they should be located where least liable to damage.

Motors, especially alternating-current machines, have from experience been found to require little if any more attention than the transmission machinery which they replace. The alternating-current motor is simpler in construction than the average sausage machine, and having but a rotating motion with no rubbing parts has little to get out of order. It has stood up, with reasonable treatment, under the trying conditions in sausage plants—steam, heat, ammonia, grease, varying loads and long hours.

Simplicity helps greatly toward economy in any plant, but perhaps more in sausage plants than elsewhere. There are many trying conditions tending towards excessive wear and deterioration, and at the same time, the nature of the business and the character of the products are such that interruptions may quickly become serious and expensive. It is, therefore,

(Continued on page 203.)



Five-Horsepower Motor Direct-Connected to Boss Meat Mixer.

Fifty-Horsepower Motor Driving 35-Ton Ice Machine.

Smoked-Meat Plants—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Smoked-meat plant, located in Chicago, making sausages, bologna, lard, etc., which are stored in refrigerating rooms maintained at a temperature of 36 degrees, Fahrenheit. The ice machines operate during the summer months only. The plant produces from 6 to 8 tubs of lard (60 pounds each) and a total of 600 pounds of sausage per week.

Total connected horsepower, 15.5. Total number of motors installed, 2. Average kilowatt-hours per month, 276.

Kilowatt-hour consumption for 12 months: January, 41; February, 35; March, 25; April, 161; May, 313; June, 408; July, 653; August, 476; September, 633; October, 365; November, 138; December, 70.

Load-factor, 3.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,120	Belted to a 15-foot shaft (5 hangers) driving one Brunswick four-ton ammonia compressor; one J. E. Smith vertical agitator; one Buffalo No. 27 silent meat grinder; one small sausage-meat mixer; one Enterprise No. 62 meat grinder; one spice grinder; and one bone grinder.
1	0.5	1,700	Single-phase motor belted to an Enterprise small meat chopper.

Energy is purchased from the Sanitary District of Chicago.

Sausage plant, killing an average of 200 hogs per week. An ice machine in conjunction with the plant is in operation during the summer months.

Total connected horsepower, 90. Total number of motors installed, 4. Average kilowatt-hours per month, 3,760.

Kilowatt-hour consumption for 12 months: January, 860; February, 1,290; March, 980; April, 5,930; May, 5,200; June, 7,070; July, 7,080; August, 7,350; September, 4,780; October, 2,860; November, 860; December, 860.

Load-factor, 7.6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	20	1,120	Belted to a four-foot shaft (two hangers) and a four-hanger countershaft driving one link-belt hoist, 12-foot lift; one 12-foot by 62-inch diameter revolving hog scraper.
1	20	1,120	Belted to 24-foot shaft (five hangers) and one two-hanger countershaft driving one Enterprise No. 66 sausage grinder; one Buffalo No. 38 sausage grinder; one Boss No. 2 sausage mixer; and one 16-inch by 3-inch revolving bologna cutter.
1	10	1,200	Belted to 12-foot shaft and two-hanger countershaft driving one Brecht lard machine; one J. E. Smith lard mixer.
1	40	1,120	Belted to a York duplex 20-ton ammonia compressor, operating at 75 revolutions per minute.

All motors are of the squirrel-cage induction type.

Standard Sausage Company, Chicago, Ill., manufacturers of sausage, bologna and lard. A 35-ton ice machine is operated during the summer months. Combination drive. Running hours varies according to demand.

Total connected horsepower, 130. Total number of motors installed, 10. Average kilowatt-hours per month, 9,043.

Kilowatt-hour consumption for six months: January, 4,534; February, 4,345; March, 4,684; April, 10,379; May, 14,925; June, 17,391.

Load-factor, 12.6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,200	Geared direct to one No. 2 Boss sausage meat mixer.
1	7.5	1,120	Geared direct to one Enterprise No. 26 sausage grinder.
1	10	1,120	Belted to a 12-foot three-hanger line shaft and an 8-foot three-hanger countershaft driving one Enterprise No. 66 sausage grinder; one New Rapid ice breaker; one S. Oppenheimer fat cutter and one Oppenheimer head-cheese cutter.
2	20	1,120	Each direct-connected to a Buffalo silent cutter (42-inch bowl).
1	7.5	1,200	Belted to a five-foot two-hanger shaft driving one Enterprise No. 66 meat chopper; and one Boss No. 2 sausage meat mixer.
1	5	1,120	Belted to two-hanger countershaft driving one 9-blade rocker and one small grindstone.
1	5	1,200	Belted direct to a brine pump.
1	50	600	Belted direct to a 35-ton Linde ice machine.
1	20	900	Geared to mechanism of freight elevator.

Energy is supplied by the Sanitary District of Chicago.

Smoked-Meat Plants—Data Sheet No. 2.

Sausage, bologna and lard plant manufacturing about 1,500 pounds of ice daily, in addition. The storage rooms for the meat are also cooled by the ice machine. Combination drive. Running hours per week, 60.

Total connected horsepower, 17.5. Total number of motors installed, 2. Average kilowatt-hours per month, 756.

Kilowatt-hour consumption for 12 months: January, 209; February, 212; March, 219; April, 486; May, 732; June, 849; July, 1,287; August, 1292; September 1,355; October, 1,222; November, 803; December, 414.

Load-factor, 7.8 per cent; operating-time load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,700	Direct-connected to a Buffalo No. 32 silent sausage cutter.
1	10	1,120	Belted to a 15-foot shaft (4 hangers) driving one Brunswick four-ton ammonia compressor, operating only during the summer months; one Schwenger & Klein sausage mixer, 300-pound capacity; one small spice grinder; and one Enterprise No. 66 sausage grinder.

The motors installed are of the squirrel-cage induction type.

Sausage plant located in Chicago, manufacturing from 2 to 3 tons of sausage per day of 11 hours. Individual drive. Running hours per week, 66.

Total connected horsepower, 53.25. Total number of motors installed, 7. Average kilowatt-hours per month, 4,144.

Kilowatt-hour consumption for 12 months: January, 687; February, 672; March, 661; April, 809; May, 3,903; June, 6,964; July, 7,910; August, 7,429; September, 1,085; October, 6,789; November, 6,704; December, 6,124.

Load factor, 14.2 per cent; operating-time load factor, 36.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts; and 500 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Type.	Application.
1	15	850	Squirrel-cage	Belted to a meat grinding machine.
1	20	1,700	Squirrel-cage	Geared to a silent mixing machine.
1	5	1,700	Squirrel-cage	Geared to a 1,500-pound mixing machine.
1	5	1,650	Compound-wound	Belted to a 2,000-pound elevator.
1	5	1,150	Shunt-wound	Belted to a 200-pound ice crusher.
1	3	1,600	Shunt-wound	Belted to a small centrifugal pump.
1	0.25	1,800	Shunt-wound	Driving a sausage cover-applying machine.

Energy is supplied by the Sanitary District of Chicago.

Sausage plant having an average daily output of 1,400 pounds of meat. An ice machine is operated during the summer months only.

Total connected horsepower, 20. Total number of motors installed, 2. Average kilowatt-hours per month, 735.

Kilowatt-hour consumption for 9 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
July	1,045	October	1,119	January	355
August	1,285	November	625	February	372
September	1,258	December	312	March	246

Load-factor, 6.6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,120	Belted direct to a Remmington four-ton ice machine.
1	10	1,120	Belted to a 15-foot four-hanger shaft driving one Enterprise No. 62 meat chopper, 300 revolutions per minute; and one J. C. Smith's Sons silent meat grinder. Capacity, 3,000 pounds per hour.

Nuckolls Packing Company, Pueblo, Colo., meat-packing establishment. Operates a seven-ton Althoff ice machine. Average running hours per week, 42.

Motor is direct-current, 500-volt, 10-horsepower machine, belted to a countershaft driving the refrigerating machine. The refrigerator has a capacity of 40 head of cattle and 12 tons of lard, and an average temperature of 38 degrees Fahrenheit is maintained.

Average kilowatt-hours per month, 1,057.

Kilowatt-hour consumption for twelve months:

January	12	May	1,889	September	2,065
February	0	June	1,478	October	1,231
March	1,476	July	1,478	November	144
April	1,761	August	1,137	December	20

Load-factor, 19.4 per cent.

essential that all machinery and arrangements of machinery upon which the operation of the plant depends, should be as simple as possible and accomplish the desired results.

In arranging the electrical equipment, the motors should be coupled directly to the apparatus driven, wherever practicable. This cannot be done very fully on account of the rather high speeds of the motors in comparison with the usual speeds of machinery used, but it can frequently be done with fans, blowers and rotary pumps. Duplex and triplex power pumps are usually motor driven by gearing directly to the countershafts forming a part of them.

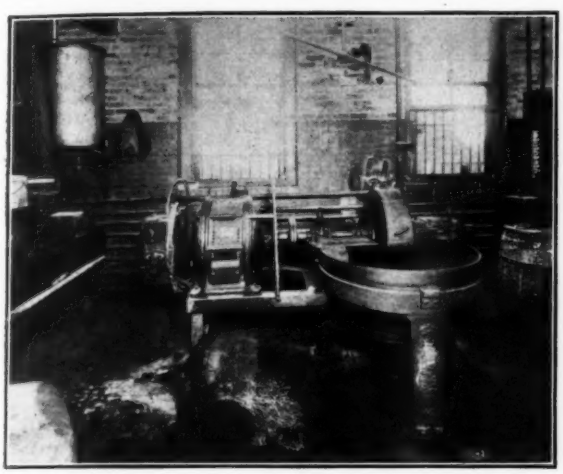
The most common drive is to belt to the machine direct or through a countershaft, for the reason that most machines are so designed and run at such speeds that this is the most practicable method. An Enterprise hasher takes enough power and is sufficiently independent to warrant the use of a separate motor, which would naturally be connected to it through a countershaft. If a No. 66 hasher is used it requires a 15-horsepower motor, while if No. 72, a 20-horsepower motor. Silent cutters run at such speeds that the motor can usually be belted or geared directly to them. A cutter with a 42-inch bowl requires 20 horsepower, while a 500-pound mixer, if driven separately requires a five-horsepower motor. A Ferris wheel or Hurford hog hoist or a set of 7 lard rolls, because of their slow speed, require several reductions from the motor pulley, which can best be accomplished by pulley and belts. From 3 to 5 horsepower is required for these machines.

If elevators of the friction type are used, as is common in sausage plants, the motors can be belted to the shaft carrying the paper friction, and would be from 15 to 30 horsepower, depending upon the loads carried and upon the speed.

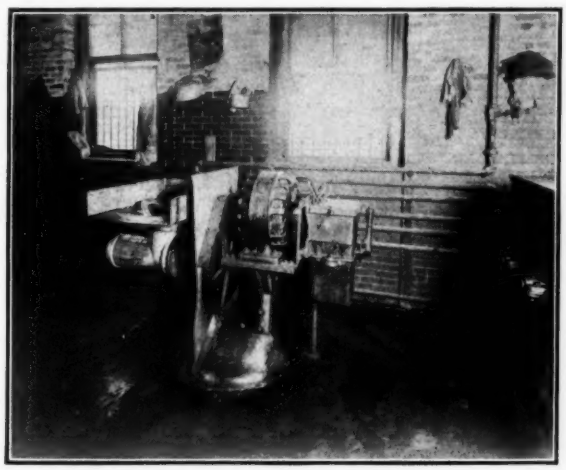
During the summer months and in many plants during the entire year, refrigeration is one of the largest items of power and the following brief discussion on motor-driven refrigeration may therefore be in order.

When a liquid is transformed into a gas, a certain amount of heat is required in the process. This heat will always be taken from the nearest source and apparently disappears into the gas. Mechanical refrigeration is the utilization of this characteristic of substances to artificially cool spaces for the preservation of perishables.

There are several systems of refrigeration in use, but the compression

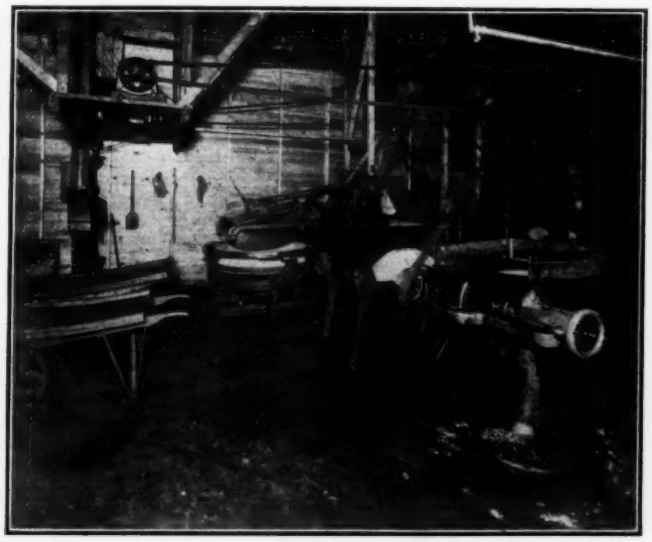


Twenty-Horsepower Motor Connected to Silent Cutter.



7.5-Horsepower Motor Geared to Enterprise Chopper.

Motor-Driven Brine Pump.



7.5-Horsepower Motor Driving Sausage Machines.

system, using ammonia as the refrigerating medium, is the most commonly used, and, therefore, will be the only one treated here. The fundamental parts of this system are: (1) A compressor in which the gaseous ammonia is compressed. (2) A condenser which cools the compressed gas, causing liquification. (3) The valve through which the liquid ammonia expands. (4) The coil placed in the cooling chamber where the vaporization of the liquid takes place. During the process of vaporization, the ammonia abstracts the necessary heat from the surrounding space.

There are two types of this system of refrigeration, in one of which the gas pipes are carried directly into the box to be refrigerated, and the other in which brine is cooled by the ammonia pipes and circulated in the pipe contained in the box to be refrigerated.

Machines are rated in tons of refrigeration capacity. One ton of refrigeration has the same cooling effect as the melting of one ton of ice in 24 hours. Power is required to operate the compressor, and in the brine system, the circulating pump.

When applying direct-current motors to refrigeration compressors, it is preferable to use compound-wound motors, in view of the heavy starting torque required and the cyclic variation in load. When applying alternating current, the smaller sizes of compressors can be operated with squirrel-cage motors, while the larger machines will usually require a wound-rotor motor on account of the high starting torque required.

The power required to drive a refrigerating machine depends to a great extent upon the temperature of the water used to cool and liquefy the compressed gas. The lower the temperature of the water, the smaller the amount of power required.

It has been found that, under proper conditions, one ton of refrigeration will cool from animal temperature to keeping temperature

	Weighing
From 15 to 24 hogs	250 pounds each
From 5 to 7 beeves	700 pounds each
From 45 to 55 calves	90 pounds each
From 55 to 70 sheep	75 pounds each

After cooling, one ton of refrigeration will preserve one ton of meat for 24 hours, when stored in proper boxes.

It is difficult to state definitely the exact sizes of motors required for the many purposes throughout packing houses on account of the various sizes and makes of machines, and the method of operating and arranging them. These are details which should be carefully studied and receive the best attention in planning an electrical system of power distribution for any specific case. Success and economy depend, to a considerable extent, upon the right subdivision, arrangement and installation.

APPROXIMATE HORSEPOWER REQUIRED TO DRIVE REFRIGERATING COMPRESSOR.

Capacity. Tons Refrigeration	Horsepower Motor Required
0.5	2
1	3
2	5
4	7.5
5	10
7.5	15
10	15
15	25
20	35
30	50
40	65
50	80

In general it is desirable that the number of different sizes of motors be kept as low as is consistent with the requirements. In most plants the requirements for sizes would run from 1 to 30 horsepower. Seldom need the motors be larger, and it is advantageous not to use much larger units if they can be avoided.

It is essential to arrange the motors and drives so that the system will be flexible, that the machines usually operated together can be driven with one motor, if it does not require too large a one, and that all motors shall be of such sizes as to be well loaded when operated under normal working conditions. Machines used intermittently should be separately driven, so they can be shut down when idle.

It is frequently desirable to use a flywheel on the shaft of the motor or the machine which it drives, in order to equalize rapidly changing loads, and thus improve the conditions under which the motor operates. The flywheel stores energy when the motor is underloaded, and gives it up and thus assists the motor when it is suddenly overloaded. The use of flywheels under these conditions tends to decrease the size of motor required. They are desirable in connection with elevators, crushers, saws and grinders, where the irregular loads impose severe and trying conditions on the motors driving them.

Motors which are subject to extreme dust or moisture conditions should be boxed or housed. Where it is necessary to place a motor in an atmosphere filled with dry tankage or fertilizer, it should be surrounded with a tight box. A motor driving a group of hog-casing machines or a pump for a hydraulic tankage press, and located under the usual conditions surrounding such apparatus, should be placed in a waterproof box, while one located where there is more or less water dripping might better be placed simply under a waterproof roof.

Where motors are inclosed, ventilation should be provided by means of a pipe or duct connecting the box or housing with the outside air whenever this is practicable. Motors thus inclosed, unless thoroughly ventilated, should be somewhat larger than those doing the same amount of work in the open air. Without good ventilation the tendency to heat is excessive.

Electric power should certainly be considered for use in new plants of almost any size, and it has been found to pay large returns on the cost of installation in some old ones, even when considering the sacrifices which have been made in the equipment replaced.

The Electrical Industry in Japan.

Among the numerous Western industries which have had a remarkable development in Japan during the past thirty years or so, one of the most interesting is electricity. For some years after the country was opened to Western intercourse the application of electricity was, for the most part, confined to telegraphy, but after the graduates of the Imperial College of Engineering had been for some time at work, the applications became very numerous. Not only are the telegraph and telephone systems of Japan very well developed, but electric railways are now common, while electrical power stations are being rapidly extended. The geological and topographical formation of Japan, and its abundant water supply, give it peculiar advantages for utilizing, for industrial purposes, the numerous sources of water power which are to be found, and, indeed, so great has been the development in this direction that it has had an appreciable effect on the coal consumption. The Japanese take long views of the industrial and economic problems with which they are confronted, and there seems to be a settled policy to economize coal by utilizing to the utmost the available sources of water power.

The number of cities, towns, and villages in which electricity had been adopted for lighting purposes was 1,133 at the end of 1910. The number increased to 1,367 at the end of September, last year. The total number of electric lamps at the latter date was 2,121,738, being an increase of about 14 per cent over that at the end of 1910. The increase of electric lamps, of course, means the increase of the demand for power. The number of households using electric lamps increased to about 740,000 at the end of the first half of last year, an increase of about 70,000 households in six months. The rate of increase, as compared with the growth of telephone installations, which have had a remarkable development in recent years, has been about five times as great, thus testifying to the rapid growth of the demand for electricity for lighting purposes.—*Engineering.*

Commercial Practice
Management, Rates, New Business

ELECTRICITY IN RURAL DISTRICTS[1].

By J. C. Matthieu.[2]

Conditions change as years pass—what was satisfying ten years ago is not altogether agreeable now—our demands are growing with the times. This is especially true in the central station development. A few years ago we hardly would have entertained the idea of extending our lines into the rural districts, primarily, perhaps, because the field for our development and progress was nearer at hand and greater returns could be realized on our investment without a far-reaching net work of lines, necessitating large expenditures. But as time rolls on and the immediate vicinity of the central station is more fully developed, it necessitates that the live up-to-the-minute corporation seek a new and undeveloped market to increase the sale of electricity.

Why is the rural district not our logical market? Rural districts do not necessarily mean isolated farms, but rather small villages which can offer a good return on the investment, and along these transmission lines encourage the use of electricity on the farm.

Before taking on any rural business the company should have in mind some definite, concrete proposition, such as a ten-year franchise for street lighting or some guaranteed equivalent from the village or some other reliable consumer. With business of this kind in view, the cost of the service should be computed. Any other business that the company may be able to secure will be so much more to its advantage. From experience it has been found necessary to have a certain fixed revenue contracted for, for a promise to use current after it is on the ground is too easily broken. People are always anxious for service until they know it can be obtained, and then they are apt to lose their enthusiasm.

The Dayton Power & Light Company is at the present time supplying current to four rural districts, varying in distance from four to eight miles, from which it is deriving a very satisfactory revenue. In these towns the company is supplying current for a total of fifty-four 75-watt series Mazda street lamps on an all-night schedule, pumping water for the villages, and in one case in addition to the pumping is furnishing 35 horsepower for a grain elevator and feed mill. The communities served are very well pleased and very good boosters. Hardly a month passes but what some community is soliciting our service, now that it is generally known that the company is making extensions to the rural districts. They do all the preliminary boosting and all the company has to do is to fix the rate and build the lines.

When a community comes to the company for service we place the burden upon its own shoulders; in other words, the company puts it up to the Improvement Association to give us a prospectus of the amount of business we can expect in residence lighting, the number of street lamps the village will contract for on a ten-year basis, etc. A few live boosters living in a town can do a great deal more than any outside parties. From this prospectus we satisfy ourselves as to whether or not we are to take on this business.

The company tries to be as fair as possible to itself and to the community and does not ask the community to come more than half way. It is our aim to assist new customers and see that they are properly cared for and that the service is right. One of the communities which we serve has so much confidence in us that whatever we may suggest is done without any hesitation on its part.

A new-business representative reads the meters each month, devoting the remainder of the day to promoting new business and handling complaints. The bills are payable at a local bank, thereby relieving customers of the trouble of coming to our office.

The street-lighting circuit is cut in and out by means of a time switch which has been found to be very satisfactory. The matter of lamp renewals is cared for by a local party with whom the company has made arrangements to replace all burnt-out lamps and to report any trouble that might occur to the circuit. Handling the business in this manner cuts down the expense to the lowest possible figure and has been found to work out to the very best advantage to the consumer, as well as ourselves. The Dayton Power & Light Company feels that it has worked up a nice business in these towns and looks upon them with pride.

On these existing lines there is hardly a farm of any size that does not have as part of its equipment a windmill, gasoline engine or some other form of motive power. This equipment is coming into use more and more because the farmer is beginning to realize the economical advantage that machinery has over manual power. Why should we not get this business, stimulate its growth, as is being done in the electric-vehicle field today?

The possibilities of electricity on the farm have not as yet been scratched. The farmer is one of the first to adopt modern practice if he is shown. Why not exhibit at the county fair electrically driven apparatus, an advertisement any central station can make at a very small expenditure? Why not cooperate with the manufacturers of farm machinery and show the farmer the many new things that can be done with the aid of electricity? Circulate among them pamphlets and literature showing what other farmers are doing. Great results have been accomplished in other states, why not in ours?

Irrigation is destined to become one of the most important, if not the most important, economic factor of this country. Water, when and where you want it, will act as a governor regulating that great machine upon which the welfare of this entire country depends, the farm. What has a greater effect on the country than crops?

In the State of Ohio there are an innumerable number of truck farms whose success depends a great deal upon the amount of rain that falls each month and upon when it falls.

It has been determined that truck garden crops demand even distribution of from one to five inches of water per month, a greater quantity often being advantageous. Rainfall estimated over six months for a period of 28 years throughout Ohio is approximately 3.25 inches per month, an excess precipitation often following pe-

[1] Paper presented at the eighteenth annual convention of the Ohio Electric Light Association, Cedar Point, O., July 19, 1912.

[2] The Dayton Power & Light Company, Dayton, O.

riods of drought, and vice versa.

Experience has shown a crop increase of 25 to 100 per cent with plentiful wetting of the ground at plant setting and regularly applied irrigation of two to three inches of water per week in one to three applications, depending on the weather and the extent of natural rainfall. Artificial irrigation enables the gardner to force a rapid yield, as vegetables may be set or transplanted without waiting a fortnight or more for natural moistening of the ground.

The sprinkling method is chiefly used by the truck gardener. Water is supplied to the soil by sprinkling with an arrangement of nozzles attached to a movable section of pipes. These pipes are placed 60 feet apart and are from three to ten feet above the ground, which enables an unhampered cultivation of the soil. The main pipe, two to four inches in diameter, is usually laid across the field below the frost level. Water is pumped directly into the pipe and maintained at a pressure of 40 to 60 pounds. This system is also maintained in the greenhouses.

In some instances motors are used to increase circulation of the water in the heating pipes in greenhouses, thereby saving the coal bill. The centrifugal pump is perhaps the most popular owing to the fact that the initial expense is much less than for any other types of equipment, and also to its adaptability to handle foreign substances. The very fact that the pump can be left, without an attendant, running at any hour of the day, is what would appeal to our friend the farmer. One motor of, say, 10 horsepower rating can be used on the farm as the general-utility motor is about the city home—an article which when once used becomes indispensable. There are a great many other uses that a motor can be put to, such as feed grinders, hay presses, silage grinders, threshing, corn shellers, and refrigerating machinery. There are many duties which could be performed about the farm after dark if the farmer had the proper light to do the same, and it would only be necessary to bring this matter to his attention. The probable consumption of the motor on the farm would be about 200 kilowatt-hours per month.

In Europe we are told that a network of wires is spread over the fields positively charged at a high potential, and the negative conductor is grounded, which stimulates the growth of the crops to a marked degree. The theory advanced is that the flow of sap is stimulated and nitrogen of the air freed and made available as a fertilizing agent. This method of stimulating growth may seem a long way off, but only shows the possibility of electricity on the farm.

The writer has here attempted to show some of the advantages of electricity on the farm and possibilities to be found there by the central station.

Summer Display.

The Philadelphia Electric Company has a novel summer display in the window of its store at Tenth and Chestnut Streets. The display includes a compact electric fan, an electric toaster, a small electric iron, and about ten other handy articles for the vacation, all packed together in the tray of a small trunk.

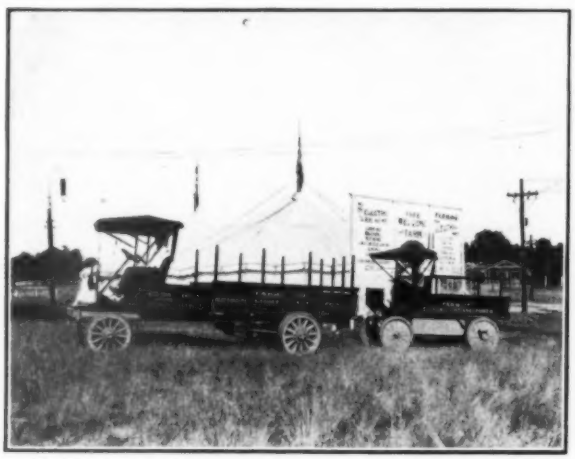
Ironing on the Back Porch.

In a recent campaign for electric irons, Clare N. Stannard, commercial manager of the Denver Gas and Electric Light Company, calls attention to the fact that ironing with an electric iron can be done on the porch or anywhere else where an electric socket is available. This is a strong talking point in summer weather.

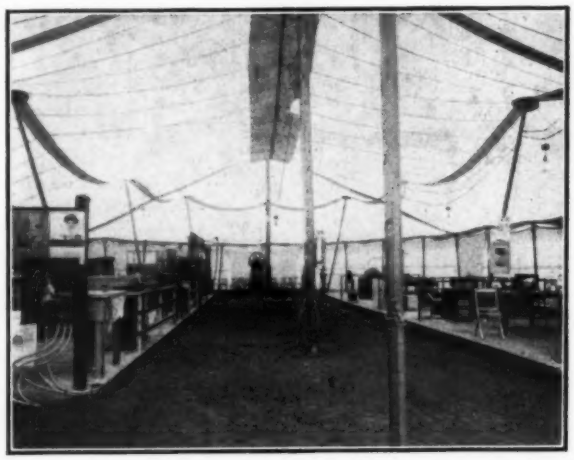
THE FARM OF EDISON LIGHT AND POWER.

A Unique, Practical, and Valuable Exhibit by The Edison Electric Illuminating Company of Boston.

Exhibits, more or less incomplete, have been made from time to time of electrical apparatus available for farm use. They have been incomplete because the exhibits have been made by individual manufacturers who have shown only the lines they were commercializing; in other cases, central stations have gotten together the electrical apparatus, available, for example, for irrigating purposes; others have shown dairy equipments; but it has remained for The Edison Electric Illuminating Company of Boston to get together what may be regarded as a complete and practical exhibit of appliances available for use on the farm, as well as in all phases of farm activity.



Outside View of Edison Farm, Showing Trucks.

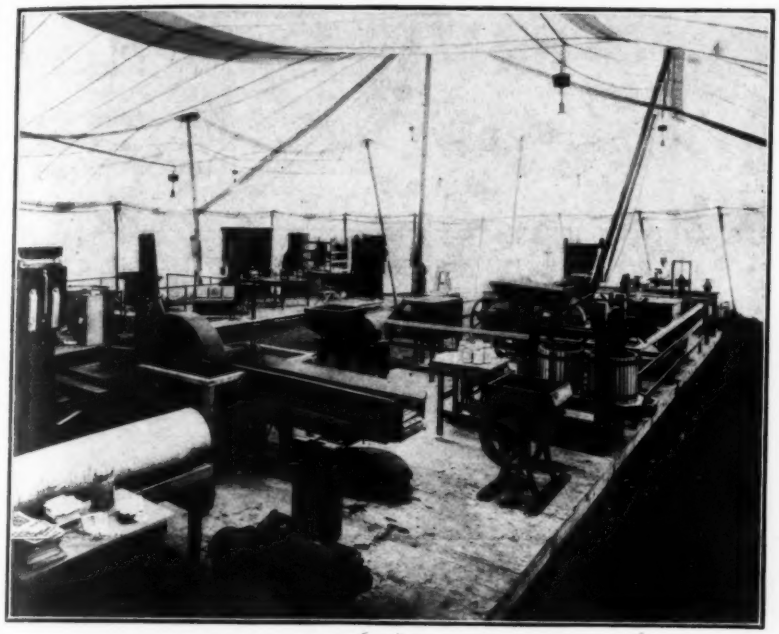


General Inside View of Main Tent.

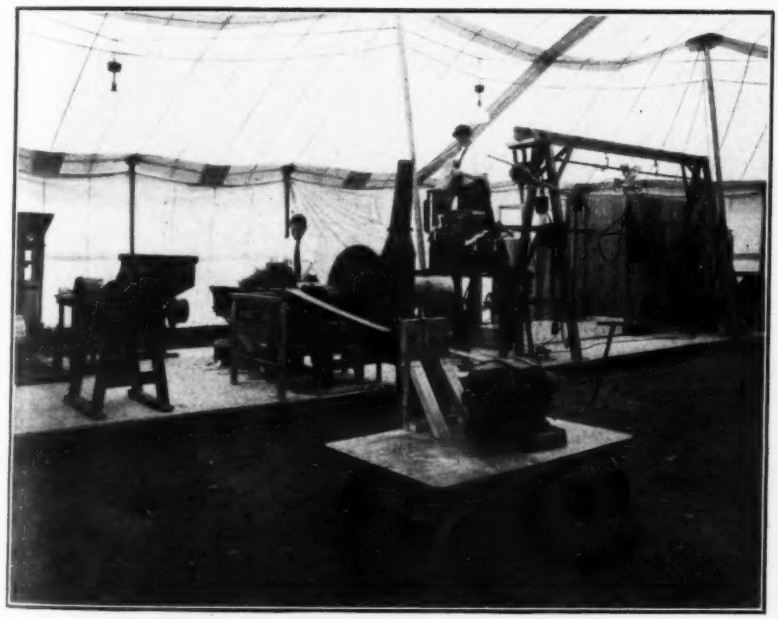
Six months ago, W. H. Atkins, general superintendent of The Boston Edison Company, inspired his associates with the practicability of this enterprise. Six weeks ago the farm was opened to visitors, and the attendance of interested people has averaged about 100 a day—this not counting the children and people obviously attracted out of curiosity.

"The Farm" consists in the grouping of some 40 large pieces of apparatus and farming tools, together with 30 or 40 of the ordinary and smaller appliances, in a big tent, 60 by 106 feet in size. All the apparatus is practical for use and for economic service on the average farm. Each appliance is plainly marked with its name, the manufacturer, its price, and the cost of operation. The price is retail and includes the machine, its motor and everything ready for actual service on the farm.

Some machines and tools have been omitted from the exhibition because they have been regarded as impracticable—at least for use in New England territory. Others are not shown because it has not been possible to "standardize" them, that is, furnish them to the purchaser with "everything all on" ready for operation.



General View.—Home Section in Background.



Feed Cutters, Grinders, Etc., Driven by Portable Motor.

For the first five weeks the Farm was located on the Old Middlesex South Fair Grounds in South Framingham, a suburb of Boston, easily reached by the electric car lines. The main poles of the tent are surmounted with pennants, and in front of the main entrance have been placed three large display signs gotten up in striking colors to add some of the "drawing" effect of a high-class circus. The scheme has proved effective. A broad, main passageway extends down the center of the tent from end to end. On either side are the working exhibits protected from the visiting throng by railings. The tent is brilliantly lighted at night with 500-watt Mazda lamps, and the outside with luminous arcs.

Two electric trucks, one of two-ton capacity of the General Motor Truck Company; and another of 700-pounds capacity manufactured by the Walker Vehicle Company, are used in connection with the farm for hauling material to and fro. A special feature of the truck service has been in demonstrations for the neighboring farmers. Wherever the farmers have shown interest in the truck proposition, the vehicle suited to the service has been sent out to haul loads around on the farm. From time to time material has been carried from farms into town, or *vice versa*. The result has been that many of the farmers have now practical knowledge of the working efficiency of an electric truck on the farm, and are considering its adoption.

A partial list of the apparatus shown on the farm is as follows: cider mill, vegetable cutter, electrobator, electric brooder and bone cutter, milk tester, milking machine and vacuum-cleaner outfit, butter churn, cream separator, bottle-washing machine, grindstone, horse clipper, forge blower, circular saw, wood saw, wood splitter, portable breast drill, furnace blower, meat chopper, oat crusher, electric pump for farm storage supply system and irrigation, pumping jack for attachment to windmill outfits, motor-operated sewing machine, vegetable peeler, battery-charging rectifier outfit, ice-cream freezer, corn sheller, clover cutter, feed grinder, friction windlass, ensilage cutter, hay unloader, electric kitchenette, washing machine, flat-irons, and all electric household utensils, as well as buffing and grinding outfits, and all electric appliances for use in a carpenter or repair shop.

The authoritative tests of the efficiency of some of the important pieces of apparatus at the farm show the following results:

Clover Cutter.—0.5-horsepower motor; rate per hour, 41 pounds of finely cut clover; kilowatt hours per 100 pounds, 0.870; average horsepower, 0.48.

Milking Machine.—Capacity, 10 machines, 20 cows; 3-horsepower motor; tests, 8 machines used, 90 cows milked; give 432 quarts milk; rate per hour, 91 cows; kilowatt hours per hour, 0.019; average horsepower, 2.3.

Corn Sheller.—Capacity, 26.5 bushels flint corn per hour; kilowatt hours per bushel, 0.0278; average horsepower, 0.98.

Washing Machine.—Capacity, 6 sheets per washer-full; 0.125 horsepower motor; rate per hour, 6 washers-full; kilowatt hours per washer-full, 0.0232; average horsepower, 0.187.

Feed Grinder.—Capacity, 6.2 bushels per hour with 5-horsepower motor; grinding shelled Flint corn fine; rate per hour, 6.02 bushels; kilowatt hours per bushel, 0.710; average horsepower, 5.9. Grinding

Flint ear corn fine, 4 bushels per hour; 5-horsepower motor; kilowatt hours per bushel, 0.888; average horsepower, 4.7. Grinding Flint corn and oats, half and half, 4.6 bushels per hour; kilowatt hours per bushel, 0.821; average horsepower, 5.08.

Oat Crusher.—Capacity, 50.5 bushels per hour; 2-horsepower motor; kilowatt-hours per bushel, 10.5; average horsepower, 3.04.

Ensilage Cutter.—Capacity, 2.6 tons of rye per hour; 10-horsepower motor, kilowatt hours per ton, 3.11; average horsepower, 11.3.

The farm is equipped with a motor on a portable truck, which can be moved from place to place and connected up with any piece of apparatus. This shows the practicability of portable electric power on the farm.

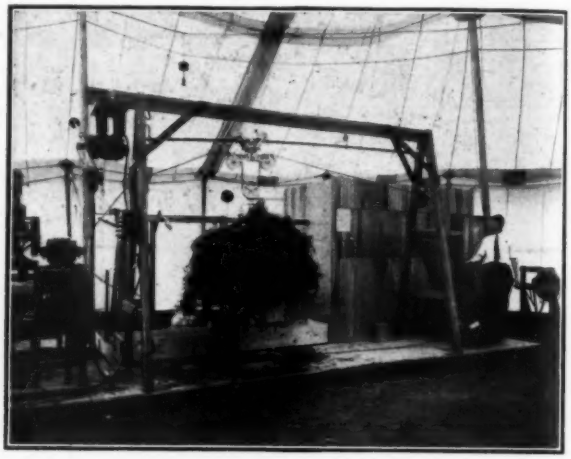
The milking tests prove very attractive for the people, and there is always a crowd at the evening milking time. Practical milking demonstrations have been given at large nearby dairy farms, to the great satisfaction of dairymen.

The farm is resulting in excellent business, and many of the purchases of electric appliances are traceable directly to the inspiration and information gained at the farm. The exhibit will be moved to other neighboring towns during the summer, as has been done with the portable "Electric Home."

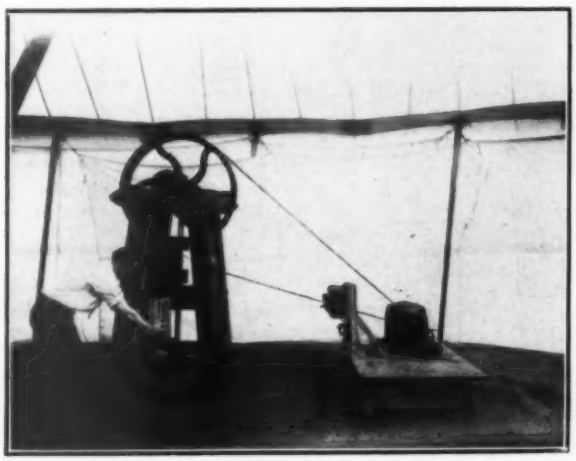
Systematic Advertising and Progress.

W. C. P. Tapper, engineer and manager of Stepney (London) municipal electricity supply undertaking, in reporting a remarkable tale of progress for the past year—an increase of output from 8,677,759 to 13,735,286 kilowatt-hours—says: "Apart from the obvious use of a showroom, viz., to exhibit the latest developments of the application of electricity, the showroom represents the business-getting and publicity work of the undertaking. There can be little doubt that the remarkable increase in the sales during the past year is to a very large extent the result of the systematic advertising throughout the borough and canvassing both by the regular distribution of suitable literature and frequent personal calls, which have been energetically carried on for some years past." The increase in units sold was 31 per cent more than double the rate of any previous year. Consumers paid only 2.62 cents per kilowatt-hour as compared with 2.84 cents in the preceding year. Notwithstanding the coal strike and the greatly increased output, the cost of coal fell from $67,660 to $59,975, and from 0.75 to 0.42 cent per kilowatt-hour. The reasons for this economy are found in the fact that the new generating station at Limehouse under condensing conditions has been at work for the complete year. Furthermore, transferring the load from the Whitechapel to Limehouse station has led to coal transport economies, fuel being delivered alongside from barges instead of by carts. Works cost per unit fell by 30 per cent. The continued progress of the Stepney system has necessitated extensions costing $688,750, soon to be undertaken.

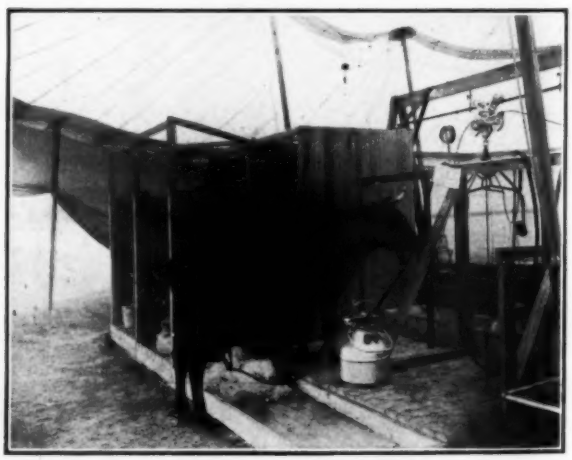
General View, Looking Toward Entrance.



Wood-Splitter in Operation.



Hay Unloader in Operation.



Apparatus for Milking Cow.

Electrical Construction

WIRING IN CAR SHOPS.

By H. G. Wilson.

In box and passenger-car repair and building shops there is, as a rule, a wide field for improvement in the electrical conditions. The principal defects common to a number of such shops are that ordinary drop cord is used for a combination of a hanging and extension lights, subject to being pulled through the car windows, trampled on and to all of the treatment generally accorded to the weakest part of the entire installation; there is open wiring on low ceilings, that is, low when it is remembered that the employees work on the top of the cars as well as on other parts; unprotected wiring is subjected to mechanical injury; and circuits are very much overloaded, due in part to the use of numerous portable electrically driven hand tools, which are plugged into the lamp sockets, with the consequent overfusing of branch circuits all the way from ten amperes to No. 14 copper wire and hairpins ingeniously bent to meet the demands of the moment. The moment, being a elastic one, stretches until a fire occurs or a general overhauling is required by the powers that be.

Some cases were found recently where 220 volts was necessary for the operation of tools, and to meet these conditions the two outside wires of the three-wire lighting circuits were run to a convenient post and there terminated at Edison plug-fuse bases, the circuit wires of the portable cord on the tool being fastened into two blown plugs and then screwed into the bases.

However, there are always exceptions, and one of these might prove interesting as showing how a little care will repay the time and money required many times over.

Conduit was used wherever possible in this particular shop to be mentioned now. A main service-switch cabinet and distribution center was located centrally with regard to the load carried, and the circuits for the different groups of branch circuits were fused therein and then run in conduit to the branch cutout cabinets located at the places most convenient from an installation and operation viewpoint. Wherever it was necessary, 220-volt circuits were run for the use of tools, plugging receptacles being used, which prevented anything else being employed except the part designed for this purpose. Flaming arc lamps were used for general illumination, and for the combination hanging and portable light necessary for the car aisles and inside work in the cars, conduit was run on the roof trusses and placed to hang in the center of the aisles. Especial care was used in anchoring taps in the outlet boxes for the drops, to prevent the weight

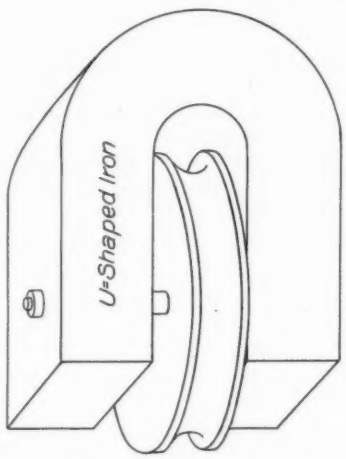


Fig. 1.—Special Device for Holding Drop.

of the adjuster and other strains from causing trouble.

Reinforced drop cord was used exclusively and a special adjuster, shown in Fig. 1, was designed to meet the conditions existing.

The weight of the U-shaped casting is about five pounds, so that it is sufficient to unterbalance the weight of the socket, etc., allowing it to hang when not in use about eight feet above the floor. The larger diameter of the shellacked hardwood pulleys (three and one-half inches) prevents undue wear of the cord. For the top pulley a U-shaped piece of hardwood is used, this being securely anchored by means of flexible wire and screw eyes to the roof trusses, so that as much strain as possible is diverted from the outlet boxes.

Locating Cable Grounds.

In underground distributing systems, one or more conductors may become grounded, and circumstances demand that that particular conductor be back in service quickly. Unless the ground produces such violent disturbances that no doubt exists of its location, it is necessary to either cut until the fault is located, which is generally very slow, or else subject the grounded conductor to tests to determine the exact location.

The very satisfactory apparatus described can be easily and cheaply made. The only expensive part is a direct-reading, differential millivoltmeter having the zero in the middle of the scale, which reads 75 millivolts on either side of the zero point. Mount on a piece of well seasoned 5-by-18-by-1-inch oak four binding-posts, *A*, *B*, *C*, *D*, and two lamp sockets, *L*, *L*, as shown; *M* and *N* are two small wire brads driven in the board, leaving only one-eighth inch projecting. (See figure on next page.)

From *A* to *N*, *N* to *M* and *M* to *B*, paste strips of paper 1 inch wide upon which a scale has been drawn, with divisions every one-eighth inch, which will give 200 divisions. Mark every second division from 0 to 100, starting at *A*. Then stretch a piece of No. 26 or 28 B. & S. gauge, german-silver wire from *A* around *M* and *N* to *B*. This wire must be stretched tightly so that reading the scale will give correct proportional lengths of wire.

The lamp sockets are to be wired in parallel. Connect permanently to *D* a piece of flexible wire (lamp cord will do) to the end of which is soldered a knife-edge contact. This wire must reach from post *D* to post *A*. Binding posts *A* and *B* must have two connectors, as two sets of leads are fastened to them; this completes the testing set.

To prepare for the test, connect to the binding posts *A* and *B*, respectively, one lead to the station end of the grounded conductor and one lead to a conductor parallel to the grounded conductor and having the same destination. The ends of these two conductors, away from the testing set, must be joined together. Connect the millivoltmeter to the posts *A* and *B*.

If a 125-volt direct-current circuit is convenient, connect one side to post *C* and ground the other, and place two 16-candlepower lamps in the sockets. If no

direct-current circuit is available, five or six battery cells connected in series can be used. Connect one terminal to C and ground the other; short-circuit the lamp sockets with a plug fuse.

To locate the grounded point, run the knife-edge contact connected to D along the graduated wire until the millivoltmeter reads zero. Suppose the reading on the wire is 25 divisions from A. Referring to the lower diagram, if the total length of the cable loop is L, and the distance from the station to the ground is X, then the following proportion holds good:

$$25 : X = 75 : L - X$$

solving for X,

$$75\ X = 25\ L - 25\ X$$

$$100\ X = 25\ L$$

$$X = 0.25\ L$$

and if the length of the cable is known, the distance X can readily be determined.

Calling the distance from A to the point on the slide wire which gives zero deflection on the millivoltmeter G, and the distance from B around to this point H, also the total loop length of the conductor, and the distance from the station to the ground, L and X, respectively, as before, then:

$$G : X = H : L - X$$

$$G\ L - G\ X = H\ X \qquad (1)$$

but G plus H equals 100; therefore,

$$H = 100 - G \qquad (2)$$

substituting (2) in (1),

$$G\ L - G\ X = 100\ X - G\ X$$

$$100\ X = G\ L$$

$$X = G \times L/100$$

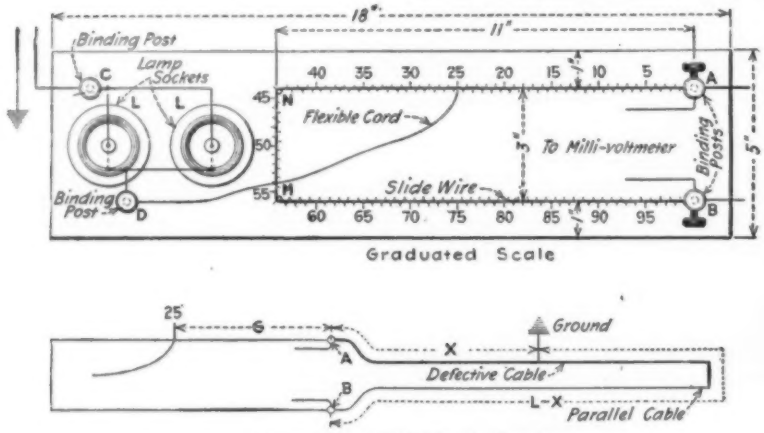


Diagram of Testing Set in Service.

which is the formula to be used when locating grounds with this apparatus.

If the ground is due to water—which will mean that it is not confined to one point—this method is not very satisfactory. If two or three conductors in the faulty cable are grounded, thus making it impossible to get a cable clear from ground for a return, it will, in all probability, be unnecessary to make the location test as a double ground is equivalent to a short-circuit, and short-circuits are usually very apparent.—*Power.*

A STATIC PRANK AND A CONCLUSION.

By Philip Edelman.

During a recent electrical storm at Minneapolis, Minn., the discharge from one bolt of lightning, evidently surged through the power line, with the following freak result, which should prove of interest.

It entered a residence, passing through the main switch and box without blowing the 25 ampere fuses, came to the branch box, located on the second floor, which contained four branch circuits, and then evidently took the first chance offered.

It went through one of the upper branch circuits, caused an arc in a socket which was not in use at the time, splitting the porcelain and jumping across the base of the lamp in the socket. This blackened the lamp and smashed the socket. Evidently the resulting short-circuit caused an overload, blowing the 6 ampere fuses; but stranger still, the operation lasted long enough to actually melt one of the branch wires, causing an open-circuit somewhere in the walls. The surge evidently kept up an arc in the fuse plugs during this interval, as the fuse plugs bore evidence of an arc, the fuse and a part of the electrodes being badly burned and melted. The peculiar part was that this was the only socket and the only branch circuit which was affected, although there were other sockets on the same branch.

In making repairs, it became more than a mere fuse job, for even after a new socket was in place, as well as new fuses, the branch was still dead. All the other sockets were unaffected, but those on this particular branch were dead. After testing with a battery and a telephone receiver, the cause was located as an open circuit on one of the branch wires, the other one being found intact.

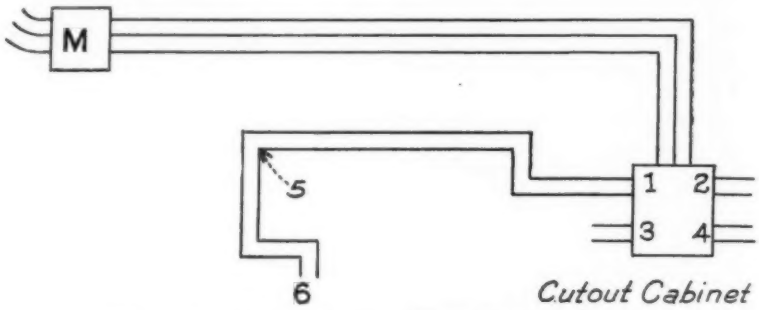


Fig. 1.—Arrangement of Circuits Where Trouble Occurred.

The break was finally located in the attic floor, just where the wire made a right-angle bend to the socket in the room below. On taking up the wire, it was found that the tube had been cracked (probably by the heat), and that the break was in the form of a uniform gap, each end of the broken wire being formed into a small bulb of copper. This illustrates the resistance of a right-angle bend to a high-frequency discharge. It is singular that only one wire fused in this manner and that the 25 ampere main fuses did not blow, tending to show that the effect was highly localized.

The conclusion is that sharp right angle bends should be avoided even in interior work, and that this freak well illustrates the need of strict, Code wiring. The ordinary demands of a wire may never even approach the capabilities of its capacity. (This branch was standard, wired with No. 14 wire, in porcelain tubes). But the large margin of safety is even too small in such cases as this. If the house had not been well wired, it is obvious that a serious fire might easily have resulted. The fact that only one socket was affected, that it was smashed and melted away by the resulting arc, that one of

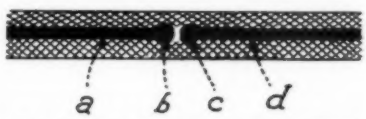


Fig. 2.—Showing How Wire Was Fused.

the wires melted at a right-angle bend, that the six-ampere branch fuses melted but still carried a current across, and that the main 25-ampere fuses were not blown, seems very strange to me.

The cuts show the layout of the circuits and how the break was situated. In Fig. 1, *M* is the main cabinet and meter. The lamp socket smashed was at *6*, in the circuit marked *1* in the branch box. At the point *5* the break in the wire occurred. Only fuses at *1* were blown, the 25-ampere fuses at *M* not being affected. The fused ends of the wire are shown at *b* and *c* in Fig. 2. The wire, *a d* is shown with the insulation on it.

Abstracts from New Wiring Rules of City of Chicago.

In almost every city of any considerable size conditions are encountered which make it necessary to adjust the wiring rules, in a measure, to meet local requirements. In the very large city there is usually such variety in the design and arrangement of buildings and in the applications of electricity as to make the rules which provide uniformly good wiring for such service quite valuable and instructive to anybody having to do with electrical construction. The latest revised rules of the Department of Electricity of the City of Chicago, which have just been issued, contain a number of important provisions which seem to be new to wiring practice. Some of these are given in substance in the following notes, and along with them there is also included some of the more interesting of the older rules of the Department.

The Department calls attention to the fact that a permit for wiring must be obtained before any work is done. The use of electric current is prohibited previous to certificate or current permit being issued.

Conditions unsafe to life or property must be corrected within forty-eight hours.

Each building into which electric current is introduced must have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the Department of Electricity; and no wires put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

Temporary work must be inspected and approved before current is used.

Alterations to existing wiring must not be made without regular permit.

Violation of any of the sections of this ordinance constitutes a misdemeanor and renders any person, firm or corporation liable to arrest and fine of not less than $50 or more than $100; also the cutting off and stopping of current used in violation until the provisions are complied with.

It is pointed out that in all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors, and the proper securing and attaching of fittings are strongly insisted upon. It is recommended that, except for constant-current systems, circuits be always, where possible, started from a center of distribution, where switches, cutouts and the like should be grouped. The load should be divided as evenly as possible among the branch circuits.

All service switches, meters and cutouts are required to be placed, when practicable, in basements or public places where they will be readily accessible to inspectors, meter readers and trouble men.

In all apartment buildings, office buildings, store buildings and in all other rented properties special meter-outlet fittings must be installed. These meter outlet fittings must be of a design approved by the Electrical Department and must be installed at the location where meter is to be set. All wires between cutout cabinet and meter outlet fittings must be placed in conduit and the wires installed and connected by the wiring contractor. The company supplying current must furnish all wires between fitting and meter and must thoroughly protect all such wires, where necessary, with flexible tubing. When meters are removed the wires between fitting and meter must be removed.

It is to be noted that the rule concerning terminal fittings for meters is a new one, and it may be appropriately added that the general adoption of some such requirement in other cities would doubtless mean a decided improvement over present wiring practice. The use of this meter-loop fitting makes it an exceedingly simple matter to install a meter or to remove it from service, and insures a type of construction which is neat looking and safe whether the meter is in place or not.

All poles and all covers for manholes must be branded or stamped with the name of the person or corporation owning the same; all electric service entrances must have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of the City Electrician.

The Department requires that all electric signs must be illuminated each night for a period which is at least from dusk to 9:30 o'clock in the evening.

The formerly existing rule with reference to ground return wires has been superseded by a new ordinance concerning electrolysis.

It is required that leads or branch circuits for alternating-current motors be designed to carry a current not less than 50 per cent greater than the rated capacity of the motor.

Service wires are not allowed to be run over any roof or along any building wall unless installed in standard conduit. It is provided, however, as in the National Code, that service wires may pass over roofs of buildings where they are maintained not less than seven feet from the highest point of flat roofs nor more than one foot from the ridge of pitched roofs; but the wires must not be attached to nor supported from such roofs.

As in the National Code, it is provided that low-potential service wires may be brought into buildings through a single-iron conduit, the conduit to be equipped with a standard service head. For overhead services the service conduit must be extended to the extreme end of that part of the building at which such service is brought out. For buildings of more than one story in height the service conduit must be carried to the level of the ceiling of the second floor, and for buildings of less than two stories in height must be carried to the highest point of that part of the building at which such service is brought out. The service wires must in no case be within easy reach from any part of the building, and there must be no joints in the service wires between the service cutout and the point of connection to the wires from the pole.

It is required that the secondaries of transformers in distributing systems must be grounded, provided the maximum potential difference between the grounded point and any other point in the circuit does not exceed 250 volts.

The rule concerning automatic cutouts states that these must be placed on all service wires, either overhead or underground, immediately at a point where they enter the building, and within seven feet of the floor. It is provided, however, that cutouts may be located away from the point where wires enter the building when the space where said wires enter is used for purposes such that the location of the cutout therein would increase the fire hazard, in which case the wires must be incased in standard, continuous conduit from a point outside the building to the point where the cut-out is installed.

Cutouts must be installed in standard cabinets, and must be readily accessible.

The rule governing the location of

service switches is practically the same as that concerning the location of service cutouts.

In the case of open wiring on side walls, protection from mechanical injury is required to extend to a point eight and a half feet above the floor.

Wiring in all unfinished attics must be in conduit or else approved armored cable must be used.

No concealed knob-and-tube wiring is permitted, but fibrous flexible conduit may be installed in existing walls and floors of old buildings, where it is fished from outlet to outlet in places not subject to moisture. This flexible conduit is not permitted where the installation of it would make it necessary to take up floors or cut joists.

Only metal-armored circuits, except for pendant lamps, are permitted in hotels, hospitals, department stores, and in similar buildings. Flexible cords for use with pendant lamps in such places must be of the type made for portable service, and stairway lights, exit lights, and the like must be arranged for control from some point near the main entrance to the building and from that point only.

The rule book contains, in addition to the construction rules, full specifications concerning fittings and materials for wiring, these being practically the same as those found in the 1911 National Electrical Code.

Guaranteeing Wiring Work by British Contractors' Association.

The Electrical Contractors' Association, of England, has decided to formulate a scheme by which the Association itself will guarantee wiring work carried out by its members. It is proposed that the guarantee shall only extend to interior wiring and that the members who avail themselves of the privilege are to undertake to carry out the work in accordance with the Institution of Electrical Engineers' wiring rules. The liability of the Association is to be limited to $250 on each job. There is no doubt that members can derive considerable benefit in competitive bidding if they can assert that their work is guaranteed by the Association, says *Electrical Engineering*, of London. In the case of complaints by the customer, the procedure will be first to inspect the work on receipt of a fee from the customer, and if the installation is found defective the contractor will be called upon by the Association to put it right. In the event of his failing to do so, the Association will itself put the job in order and will make the contractor pay the cost of doing so.

The scheme is a useful and practicable one, in the opinion of certain English authorities, but much will depend upon how it is put into practice.

An Interesting Job of Conduit Work.

Contractors in some of the larger cities state that they have less trouble in securing electricians who can do good conduit work than in finding men familiar with high-class knob-and-tube wiring. Such a condition is by no means general, however. The fact is that there is a rather unfortunate scarcity of wiremen in many of the smaller towns throughout the country who know how conduit work should be done, and the man who has had wide experience in conduit work may usually profit by studying the methods of installation employed by others than himself.

The accompanying photographs show some high-class conduit work in a large building recently wired in Chicago. This work was installed by A. S. Schulman, a prominent electrical contractor of this city.

In Fig. 1 the method of supporting the conduit risers and the cables in them is shown. At the top of the figure an iron rack made for this purpose is seen. The rack which is attached to the building in a convenient and substantial manner, contains horizontal cross-pieces of flat iron bars drilled for bolts for holding porcelain cleats and for U-bolts to hold the conduits in place. The U-bolts can be seen in the photograph passing around the upper ends of the conduit tubes.

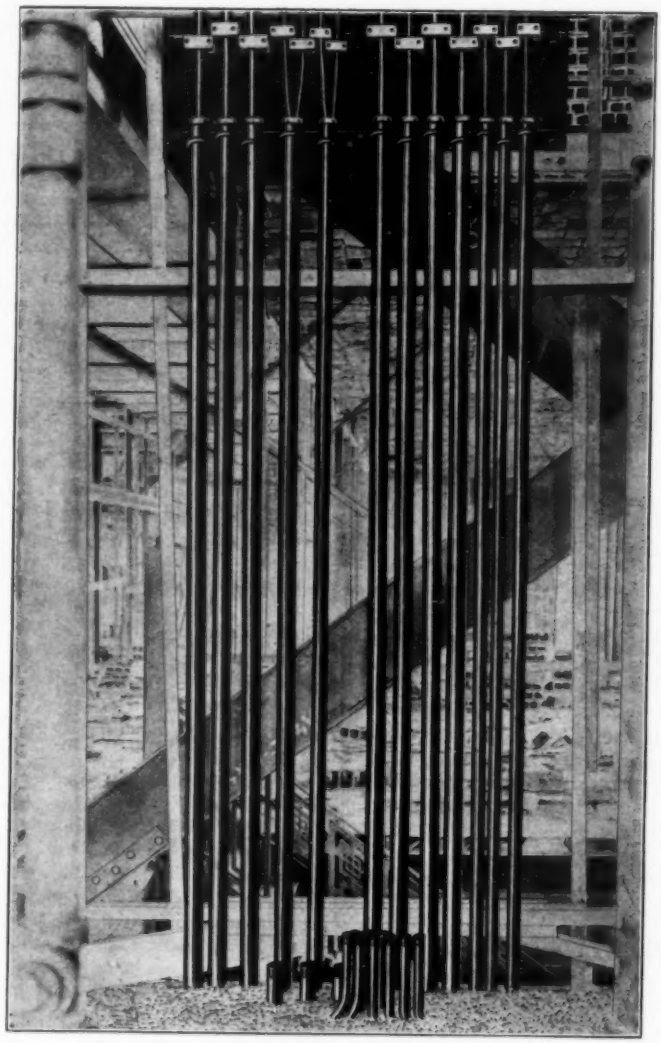


Fig. 1.—Method of Supporting Conduit and Cables.

Single-wire cleats are employed for supporting the cables, there being one cable per tube except in two of these. Where the cables are heavy enough to make this necessary the cleats are sometimes reinforced by placing a piece of strap iron on the outside of each one of them, the piece of iron being of the length and width of the cleat and having a hole in either end through which the bolt through the cleat is passed.

Only about half of the iron rack is shown in Fig. 1. To the upper side of

it the lower ends of other conduits are clamped, and into these the conductors seen in the figure pass, on the way to still higher floors. The frequency with which the conduit runs must be interrupted and the conductors supported in the way shown, or in some other way, depends upon the size of the conductors, as will be remembered from the National Electrical Code.

The construction shown here is certainly far superior to the poorly designed arrangements frequently employed for the purpose.

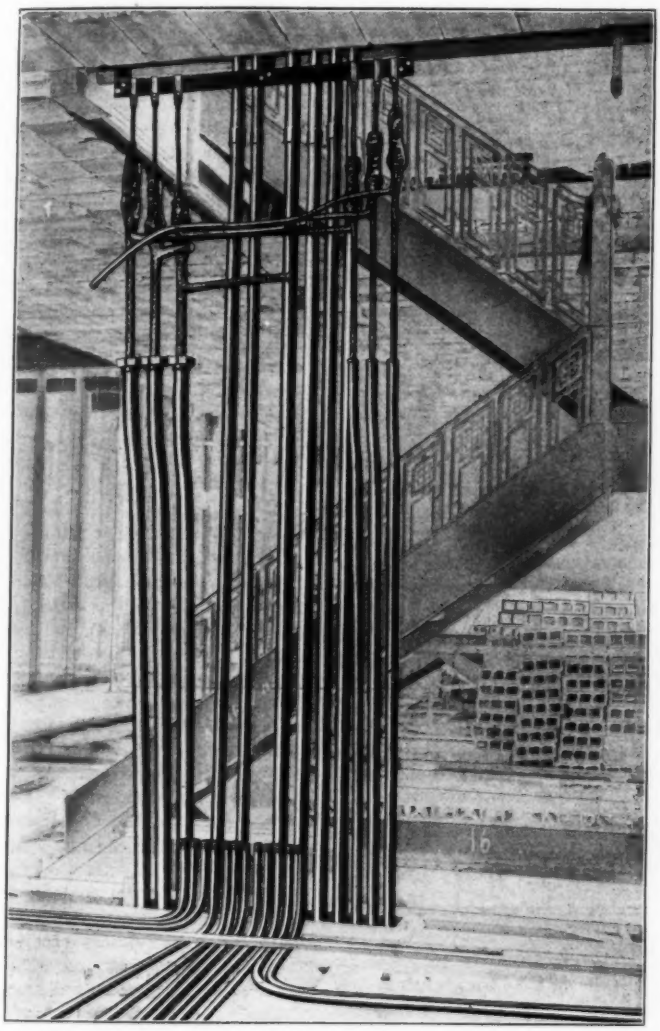


Fig. 2.—Plan of Supporting Conductors at Load Center.

At the top of Fig. 2 a substantial and neat method of supporting cables at a load center is shown. Consider the three conductors in the left-hand side of the figure. It will be noted that there is one cable per conduit, and that the three conduit pipes terminate at a point a little over halfway from the floor to the ceiling. A short distance above this point the three vertical conductors are attached to strain insulators. From the upper end of each of these strain insulators a short length of stranded-steel cable runs to a clamp which secures the top end of it to the horizontal iron support shown. The strain insulators are covered with tape.

After being passed through the strain insulators, the ends of the conductors are left free, so that the circuits for lighting and other purposes on this floor may be supplied with current from them. The connections to these circuits are made in a cabinet which had not been installed when the photograph was taken.

Cables for supplying current to higher floors are carried by the pipes seen passing through the photograph without a break in them.

At the bottom of Fig. 2 the open ends of conduits for circuits to floor and baseboard outlets are seen. It may be remarked that so good a small job of bending conduit is seldom seen.

Among the Contractors.

The United Electrical Construction Company, 417 South Dearborn Street, Chicago, has secured the contract to install the wiring for 3,000 incandescent lamps, and six motors in the Westminster Building, in this city.

Freeman, Sweet & Company, 536 South Dearborn Street, Chicago, is installing the wiring for 800 incandescent lamps and 50 motors in the plant of the Griess-Pflieger Tanning Company, in Chicago.

The Terminal Electrical Company, Limited, of Vancouver, B. C., has just established an electrical contracting and fixture business at 525 Burrard Street. K. B. Casselman, the managing director of the company, reports a very satisfactory business since the formation of the company.

The firm of George C. Hinton & Company, of Vancouver, B. C., has been awarded the contract to erect a telephone and telegraph line from Vancouver to Powell River, the contract having been let by the Canadian government, which will own the line. The distance is 100 miles, and there will be 18 miles of cable and 82 miles of overhead line.

The Bland Electric Company, of Louisville, Ky., has the contract for wiring the normal school of that city. The contract was let by the Board of Education.

Most of the trouble over cut prices on lamps, fans, etc., is believed by dealers to be due to the activity of central stations, but the experience of the Contractors' Association in Louisville, Ky., demonstrates that this is not always the case. The lighting companies, while insisting on the necessity of disposing of lamps at low prices as part of their service, agreed to uphold prices on fans, and the contractors and dealers believed that this would be made effective. However, one of the jobbing houses in Louisville jumped over the traces on this proposition, and began selling fans at reduced quotations, and this forced everybody else to reduce likewise. If the agreement had not been made, it is probable that most of those in the trade would have blamed the condition on the policy of the central stations, which, as a matter of fact, went out of their way to help the dealers in this connection.

A building erected by M. Goldstein at 200-208 South Halsted Street, Chicago, is being wired by O. M. George, 536 Monadnock Building, Chicago. Something over 1,500 incandescent lamps will be installed.

National Electrical Inspectors' Association

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Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, Wm. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, Thos. Henry Day, James E. Cole, Thos. D. McColl

Secretary's Note.

F. L. Warner writes that his address hereafter will be 405 Boulevard, Rockaway Beach, Long Island, N. Y. James S. Meade states that his address hereafter will be care Jones, Beach & Company, 50 North Seventh Street, Philadelphia, Pa. Neil Fravel has accepted a position as inspector with the Railroad Insurance Syndicate, with headquarters at 45 William Street, New York, and should be hereafter addressed there.

A Word from the President.

I am pleased to be able to announce to our membership, and to my personal friends in the electrical world, that my home has at last thrown aside the atmosphere of a hospital, and that the sick ones, who have suffered for so many weeks, are away convalescing among friends on Long Island, where, to use the slogan of the Long Island Railroad, they are being "swept by ocean breezes." I am indeed grateful to the many friends who have been solicitous concerning their welfare, and mine, and I take this opportunity of conveying to them my deepest appreciation.

We frequently meet with experiences, when engaged in our work, which ease the task and make the burden lighter. I recently inspected a temporary transformer house, the primary being 16,000 volts. I do not know of what capacity the several transformers were. They were big ones, however, and they were in a wooden building, the latter fact giving me some concern. The man in charge was a character, a genuine "hoosier" philosopher and poet. He had never heard of me, or of the office of president of the National Electrical Inspectors' Association. The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN and *Electrocraft* were magazines beyond the range of his literary knowledge and experience. The National Electrical Code contained no terrors for him, and the only interest evinced was the question, "Who wrote it?" Thus the united efforts of many had failed to reach this individual who had the care of a power plant of considerable proportions. While there is considerable which might be said against permitting inadequately equipped men to have charge of large interests, this man had a warning sign upon the door of the transformer house which was unique and expressed what was in his mind and made its purpose clear to those who read it. It was printed with a lead pencil on a piece of paper, the paper being fastened to a piece of rough board. It was a crude sign but it contained a needed truth, and brought it out in a simple manner. The language on the sign follows.

"Danger; do not touch. Move; that means U.
This is the stuff that has nothing to say;
Do not touch or you will find it that way,
And then all your friends will be standing around
To see you planted in a burying ground."

I desire to say two words, at this time. After the vacation season has past, and when the temperature begins to contribute its share to the comfort of life, I will communicate some matters to the members of the Association for their consideration.

One of those words concerns our secretary. He has been and is rendering and will render good service. We should all bear this in mind and be prompt in three things:

Help him with questions for the Association Department.

See that your account, with him, is balanced.

All the members of the Executive Committee can render him great assistance and the inspection field valuable aid in answering the questions promulgated from his office.

The other word concerns the membership of our Association. Some months ago an amendment was added to our by-laws making it permissible for manufacturers and dealers in electrical goods to join our Association; such membership to be without vote, however. Applications for membership may be made to the Secretary.

The questions in the Association Department of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN continue to excite comment and interest, and are contributing, from the advices received, in a large degree to a more general and universal interpretation and application of the National Electrical Code.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Concerning Use of Slate-Lined Doors in Metal-Lined Wooden Cabinets on Conduit Systems.

Question 191. The Code prohibits the use of wooden or composition cabinets with metal conduit, armored cable or metal molding systems. Practice allows use of large wooden cabinets metal lined for these systems, and in such a case the lining is considered as the "box," the outer wooden casing being classed merely as a stiffener. May the wooden door of such a cabinet be lined with slate instead of iron, and under what rule may it be authorized?

Answer 1. Yes. See Rule 70*d*.

Answer 2. I know of no rule prohibiting the use of a slate liner on the inside of a wooden door where same is used on a metal cabinet in conduit, armored cable or metal molding system.

Answer 3. The question suggests an acknowledgment of a violation of a Code rule and then seeks, in the last sentence, to acquire permission for said violation, under some rule. As the question indicates, the Code rule does not permit the use of wooden or composition cabinets with conduit, metal armored cables or metal molding. Section *b*, Rule 70, in the last sentence, is very clear upon this point. "Wooden or composition cabinets must not be used on metal conduit, armored cable or metal molding systems." If it is the practice in some territories to permit the use of metal-lined wooden or composition cabinets, in either of the above named characters of installation, then the Code is not being observed. Relative to the last section of the question, "May the wooden door of such a cabinet be lined with slate instead of iron, and under what rule may it be authorized?", there is no rule to permit it. I believe the purpose of using a metal cabinet is to assist in maintaining a good bond of all the conduits, metal armored cables and metal moldings, a matter not easily secured with a metal-lined wooden cabinet.

Answer 4. According to Rule 70*a*, metal doors may be lined with insulating material and Rule 70*d* provides for lining wooden cabinets with insulating material. Although these rules contain no direct statement regarding it, yet after considering the two together, I can see no objection to lining with insulating material the door of a metal-lined wooden cabinet.

Answer 5. The doors of wooden cut-out cabinets may be lined with slate in accordance with Rule 70*c* and *d*.

Answer 6. I can see no objection under the Code to the use of a slate lined wooden door on an iron cabinet, but at the same time there is no specific authorization for this construction. From the standpoint of the inspection department, however, the cabinet should be accepted without question if it is listed or labeled, but if not listed, it should be rejected. If there is any doubt on the part of the inspector as to whether a listed or labeled cabinet complies with the Code the matter should not be taken up with the contractor or his customer, but should be referred to the Underwriters' Laboratories for adjustment through the manufacturers. The statement by the questioner to the effect that practice allows wooden metal-lined cabinets on conduit systems, would seem to indicate the need for either correcting practice to conform to the Code, or if the practice is not objectionable and is desirable, the Code should be amended to conform to practice. Both of these matters, that is, lined wooden doors for metal cabinets, and the use of wood for stiffening purposes on the outside, might probably be the subject of amendments which should be referred to the Electrical Committee for consideration.

Answer 7. It strikes me that a cabinet constructed as described in this question may have a wooden door lined with slate. The iron in a cabinet intended to take conduit, armored cable or metal molding, is simply intended to tie the construction together for the purpose of grounding thoroughly and successfully. That being true, the only protection needed on the door is something which would protect the wood of the door from the flash of a blown fuse, and as slate is authorized under Rule 70*d*, it would seem to cover, in a roundabout way, the Code requirements.

Answer 8. It is against the National Electrical Code ruling to use wooden or composition cabinets metal or otherwise lined, and if the practice is permitted it is poor. Also, in the long run, the expense would amount to about the same owing to the necessary bonding of all metal-armored cables or conduits to assure the continuity of the system. Under National Electrical Code rules, doors of wood cabinets may be lined with slate, marble or approved composition, which must be at least one-fourth of an inch in thickness. See Rule 70*d*.

Answer 9. I would permit the use of a slate lining for a cabinet door, partly because of the precedent which we have of a *glass* front, which is authorized by the rules, and partly because the intent of Rule 70*b* is to use the metal lining to secure a proper bonding of the conduits without bond wires, and the requirement of a metal lining for a cover in no way aids this intent.

Answer 10. While the Code does not prohibit the veneering of an approved cabinet with wood, I interpret Rule 70*b* as requiring a cast or sheet metal cabinet with all conduit, armored cable or metal molding systems, and Rule 70*f* as specifying the thickness of such cabinet in any given case, whether overlaid with wood or not. The question as stated implies that wooden casings are used to give strength and stiffness, in the case of large cabinets, and that the metal lining, regardless of size, should be No. 10 gauge, as permitted under Rule 70*d* for "linings." This construction, in my opinion, is not justified by the Code, which requires increasing thickness of metal as the cabinet size is increased, not alone for mechanical strength and rigidity but also on account of the greater electrical energy centering in the larger cabinets, and the consequent possibility of burning through a thinner sheet. On any "iron-clad" job (conduit, armored cable or metal molding systems) we require a standard metal cabinet with metal door of standard Code gauge, and permit the use of a wooden finish if desired over door and casings.

Answer 11. We do not think the intent of Rule 70 of the National Electrical Code is to prohibit the use of slate on the door of such a cabinet if it is desired to use it there.

Answer 12. There is nothing in the rule to prevent using slate for a door lining in such a cabinet. But I think that it is rather stretching a point to consider that a large "cake-box" affair with sufficient give to necessitate support outside by a wooden sheath is the "cabinet" to such an extent as to free it from the effects of the second sentence of Rule 70*b*. I know that such construction is installed and is approved—the conduit clamping the thin metal firmly between check nuts passing through a hole in the wood three-eighths of an inch or more larger than that in the iron. I do not feel, however, that it is good construction and do not believe it is within the intent of the Code. In fact, I am opposed to using sheet-metal cabinets in conduit work of large capacity at all; a small arc will cut through them too easily.

Emergency Circuits in Hotels and Similar Buildings.

Question 192. Would Rule 38*a* apply to exit lights in buildings other than theaters, such as hotels, for instance?

Answer 1. No. Rule 38 covers theaters and amusement places only.

Answer 2. Rule 38*a* specifically covers theaters and moving-picture establishments, and nothing else; the preamble of this rule makes that clear.

Answer 3. Rule 38, in its present wording and application, is intended

for "Theater and Moving-Picture Establishment Wiring," and has no relation to other buildings, such as hotels.

Answer 4. Rule 38*a* would not apply to buildings other than theaters as defined in the paragraph just preceding 38*a*.

Answer 5. In lieu of specific rules in the Code, the rules for exit lights under Rule 38*a* should be applied for exit lights in hotels and other public buildings.

Answer 6. Rule 38*a* applies only to theaters and moving-picture establishments.

Answer 7. Rule 38 evidently applies to theaters and moving-picture houses only, but the idea of the question seems to me a good one, as an exit light is intended to serve as a guide board and should be applied to any building where people congregate in numbers.

Answer 8. Rule 38*a*. As the rule itself asserts, it is the intention to refer to all buildings which, due to their construction, are frequently or regularly occupied by the public in large numbers in a limited area, the seating of public naturally being congested so as to permit large numbers to view attractions concentrated in a small area. To permit the safe exit of this large body, numerous exits are provided and extra precautions are taken to insure the exits being properly designated, as in event of any interruption of the lighting system a panic might ensue. In hotels, even though large numbers of guests may be present, they are not congested or confined to a small area; also the hotel being a building usually divided into sections, hallways, rooms, etc., a fire would probably be confined to one portion, and even if the electric light failed the chance of a panic would be more remote than in a theater or other place of amusement. This is a question of life hazard and naturally all precautions should be taken to safeguard the public, but this ruling of the National Electrical Code is strictly confined to theaters or the equivalent, where the stage, scenery and appliances thereto, to a certain extent, constitute a hazard which does not exist in other public buildings.

Answer 9. No. The definition of a "theater" given in Rule 38 does not cover hotels unless they have roof gardens or large assembly halls that are frequently used as theaters or moving-picture establishments.

Answer 10. No.

Answer 11. Rule 38*a* does not apply to exit lights in any building or buildings other than those used for theater purposes or for moving-picture purposes.

Answer 12. The heading to Rule 38 says "the term theater shall mean a building or that part of a building regularly or frequently used for dramatic, operatic, moving-picture or other performances or shows, etc." Under this heading I do not see how the rule can be made to apply to hotels in general. But some of the large hotels are fitting out roof gardens, etc. One I know of has a large hall regularly fitted for musical entertainments, and moving-picture shows are provided for in another. In such a case I should unquestionably rule that Rule 38*a* applied. I have frequently felt that it might be a wise thing to call for stairway, elevator and fire-escape illumination in hotels, to have an independent and emergency source of supply, but at present the Code does not demand it, except by implication in the above-mentioned case.

The Proper Spacing of Supports for Armored Cable.

Question 193. How often is it necessary on the average to put in supports or pipe straps when installing armored cable?

Answer 1. It depends entirely upon local conditions. The wording of this question is vague.

Answer 2. The number of supports would depend upon the size of armored cable. It should be required that armored cable be firmly and rigidly secured in place.

Answer 3. The average distance between supports or pipe straps for armored cables depends entirely upon existing mechanical conditions within the building. They should be, however, near enough to each other to relieve the cable, or the wires within the cable, from all possible strain.

Answer 4. The question is one to which it is impossible to give an answer which will apply in all cases.

Answer 5. Straps supporting armored cable should be installed at sufficient intervals to rigidly support same. This would indicate supports from four to six feet apart.

Answer 6. The cable system "must be mechanically secured in position."

Answer 7. This depends entirely upon the construction of armored cable. If used in fished work, pipe straps, except at the outlets, are impossible. If the cable is installed in new construction, the support should be as required in other work, not over 4.5 feet apart.

Answer 8. Rule 27*a*, we infer this relates to armored cable run open. Rule 27*a* and "General Suggestions" on front page of Code should enable good mechanics to determine what constitutes rigid construction. Unfortunately, some mechanics seem to place armored cable on the same basis as rigid metal conduit, which leads to poor construction. Under normal conditions it will be found necessary to install pipe straps at least every two feet, and if run from joist to joist or under similar conditions where armored cable will be liable to mechanical injury, it may be found necessary to place backboard on which to fasten the armored cable.

Answer 9. The answer to this question depends, as did the answer to Question 185 (conduit systems), upon the specific judgment applied to each case. I believe the answer is and should properly be indeterminate.

Answer 10. In the case of the smaller size of cables most frequently used, we require a support at least every five feet.

Answer 11. This would depend largely on the location where armored cable is installed, size of cable, etc.

Answer 12. If the system is "fished," of course it is indeterminate. Where the cable is run exposed, frequently enough to prevent undue sagging between supports and to make a "shipshape" looking job.

Wireless Signals Received on Telephone Line.

The hourly signals sent out from the Eiffel Tower in Paris were received at Nancy upon an ordinary telephone line connected up for conversation. This statement was made by M. E. Leimer in a communication to the French Physical Society at a recent meeting.

This line is partly overhead and partly underground, and the signals were received quite as clearly as upon an ordinary wireless receiving apparatus. The telephone line has a length of 4,500 meters overhead and terminates at the exchange in an underground section 1,000 meters long. This line was connected to another, which has an overhead length of 210 meters and an underground section 500 meters long.

Legal Notes

THE DUTY OF A COMPANY IN PREVENTION OF FIRES.

By Maguire and Mooney.

Rules for the regulation and inspection of all electrical wiring, and its control in public places while in use, come under the police powers of government, since unsafe wiring is a menace to life and property. A fee for inspection does not constitute an occupation tax but it must not exceed the actual cost. The duties of operating companies in cases of fire are discussed.

While rigid inspection has, in large cities, practically eliminated electricity as a cause of fire, yet there are many times both in small and large cities when the electric current is either an indirect agent or it assists the fire after one is started. In the endeavor in the past few years, upon behalf of the public and the insurance companies, to eliminate all fires caused by recklessness or carelessness, strict rules have arisen relative to the installation and maintenance of electric wires and apparatus in buildings. These laws are uniformly reasonable, and invariably the Legislature of the State or the proper department in the city derives its authority from the general police power vested in it. Ordinarily public-service companies cannot be chargeable with the fires that arise through faulty electrical work. Such faulty work has been performed by some one who does not know much about the work; it arises frequently through the pranks of children assisted by the acquiescence of the parents in permitting them to do electrical work about the premises. For these reasons it became necessary to regulate the installation of electrical work. The propriety of such laws may sometimes be questioned but ordinarily they have been conceived as a good regulation.

A very late case has arisen in which the right of the municipality to regulate electricians and the installation of electrical work was questioned. Albert Cramer was charged with unlawfully constructing, installing, repairing and altering electrical work inside and outside of the Opera House Building in Houston, Tex. The theory on which it was claimed this was unlawfully done rested on the fact that Cramer had not made an application in writing to the city electrician for a permit for such construction. Cramer was fined $10 for doing this, and he immediately appealed the case. The law under which this prosecution was brought forbade any person, firm or corporation from doing any electrical work, either inside or outside of a building without first making application for a permit. Cramer contended that he was a mechanic, and that the ordinance requiring him to take out a license and pay the inspection fees was in conflict with the constitution of Texas.

The constitution of Texas (as well as the constitution of a majority of American states) permitted the legislature to tax incomes except that persons engaged in mechanical pursuits shall never be required to pay an occupation tax. But was this an occupation tax for pursuing the occupation of a mechanic, or was it a police regulation for the preservation of the lives and property of the citizen? Electric wires not properly insulated and not properly placed have caused the destruction of vast quantities of property, and many lives have been lost. Under some circumstances electricity is very dangerous, and yet, when properly placed, protected and handled, it is one of the most useful powers now known to man.

The Government has a right and the power to regulate the installation of electrical apparatus and all instruments in public use that are under lax supervision or installation may and do prove dangerous to life and property. The many uses to which electricity has been placed cannot now be enumerated. Cities and towns are held to have the power to establish fire limits and prevent the construction of frame buildings and buildings of other combustible material in such limits as a protection to property. Electrical apparatus improperly installed is far more dangerous to property than such structures. While a city has the right to regulate and supervise the installation of all character of electrical apparatus, on account of the danger incident thereto, under the police power, it is a further question as to whether they have the right to assess the necessary cost of such supervision upon the person or mechanic doing the work?

The court, in answering this question, held that inspection fees were not a tax in the manner in which the constitution so stated. Of course, if a city should fix fees at such a sum as would more than cover the necessary expenses incident to the proper inspection of the work, the ordinance would be improper and the courts would restrain the collection of such sums.

The object and purpose of the ordinance is clearly shown to be the adoption of measures to see that electrical apparatus is so installed as not to be dangerous to the life and property of the citizens and is a proper exercise of the police power, and the fees collected cannot be construed as an occupation tax.—Ex parte Cramer, 136 S. W., 61.

However, upon the determination of this question, there yet remains the questions as to how far the city may go in dictating or regulating the manner in which the work may be performed. In Toledo vs. Winters, 10 Ohio N. P. N. S., 661, an action to recover for permits issued by the city to the defendants to install electrical wiring, it was held that a provision of an ordinance that the electrical inspector should adopt rules for the installation of electrical wiring, and that all electrical construction, material, and appliances should be constructed and installed in conformity with the rules and requirements of the National Electrical Code, was valid.

In the case of State vs. Gantz, 50 So. 524, the State of Louisiana brought a charge against Gantz that he undertook to perform the work of a master electrician without having obtained a license from the State Board of Electric Examiners and that he installed wires and apparatus to convey electric currents to a certain building connecting a certain home with electricity. Gantz relied upon the argument that unless such a license was required of all electricians the law was void. The law provided that all electrical work, except work of minor importance, must be done under the supervision of a "master electrician." The law applied

to all persons except the lighting and electric railway companies and a few others. The whole matter rested on this. Why should the companies have the right to employ unlicensed, ignorant and even untrained electricians, if they choose, while the average employer who does not come within the exemption must employ only a licensed electrician? The answer to this question determined the matter. The law was held unconstitutional, because it gave a special privilege to persons engaged in the same business in similar situations. It contravened equal rights to which all are entitled.

An ordinance prohibiting the suspension of electric wires over or upon the roofs of buildings was upheld in the case of Electric Improvement Company vs. San Francisco, 45 Fed., 593. The regulation of electric wiring must at all times be reasonable. The municipality cannot, under the guise of attempting to regulate, oppress any company, or citizen, with unreasonable rules or regulations. To permit a municipality to so act would be to endanger the very existence of electrical companies. The municipality should endeavor to enforce such regulations as will secure the social order, the life and health of the citizen, the comfort of an existence in a thickly populated community, the enjoyment of private and social life and the beneficial use of property. But in doing this the municipality cannot insist upon the companies taking the most expensive procedure. Where the same result can be obtained—where the citizen can be as well protected—by an economical method, then that method is to be preferred instead of just as effective a remedy that would cost more. The company owes a duty to itself and to its customers to produce electricity at a minimum cost, and if an ordinance prescribes an expensive method of protecting property, and the company has devised a cheaper method it should adopt the latter, the ordinance notwithstanding.

Stringing wires over buildings the court held to be a dangerous practice which the ordinance sought to prohibit. And in truth this danger is a matter of common knowledge. Even if the wires can be so put up and insulated as to be safe, and only their position raised a question as to the degree of danger, the answer would be the same. Should a raging fire occur, originated by the electric current or otherwise, these dangerous wires might so obstruct the efforts of the firemen as to result in a great destruction of property.

In further considering the question, the rules and regulations governing wires in places where no person could reach were designed to protect property from fire. Therefore, it is not only important to understand the duties of electric companies before fire, but during and after fires as well. As a preventative to fires, all reasonable care and caution must be exercised by electric companies. All the reasonable arts of insulation must be used, and the company must take care to maintain the wires in good condition. Otherwise if a fire should occur, caused by crossed wires, a cause of action would lie against the company, and if there were no third cause intervening the company would be liable. And it would be no defense to say that the owner had insurance on his building.

But if a company has exercised reasonable care it is still bound by certain rules. In an important case it was decided that an electric light company does not owe to the firemen the duty of maintaining an employe at a fire which may occur in a district which it supplies with power. This is an important decision. It involves the duty to cut off electric connection in case of fire. The widow and minor child of one Carl G. Pennebaker sued the San Joaquin Light and Power Company for damages occasioned by the death of Pennebaker. He was a member of the fire department of Fresno. A fire occurred about two o'clock in the morning in a wooden building on the outskirts of the business portion of the city. Pennebaker, in the performance of his duty, went to the fire to assist in extinguishing it. At the time the alarm was sent in notice was given to the company at its substation. This signal to the electric company did not, of course, indicate the building, nor did it indicate whether the company had light or power wires that would be affected by the fire, although the company knew that it had numerous wires within the district. The firemen arrived promptly at the scene of the fire and proceeded to fight it with water and chemicals. The building was a bicycle repair shop into which was conducted power used in operating a small lathe. The wires could not carry to exceed 260 volts. They were burned and fell to the ground and lay there. Certain firemen noticed the wires and saw that they carried a current. One or two of them received shocks and a discussion arose as to whether they were dangerous. The fire was easily subdued and Pennebaker went into the yard to help carry out the hose. His feet touched and became entangled in the wires and he pitched forward unconscious, dying in an hour. At least one of the employees of the electric company was present at the fire, but it was not shown that he was on duty, was charged with any duty, or even knew there were any wires in or about the building. The city was divided by the company into districts, and the current in these districts could be turned off at the substation. A man was maintained there day and night to do this, upon proper demand. No demand or request was made. Of course, if the current were cut off the entire district would be without light or power. These facts, it may be seen, present all the points public-service companies rely on. Now, was it the duty of the company to have disconnected its wires when the alarm was sounded; or was it the duty of the company to have an employee at the fire, to either disconnect the wires himself, or signal to the substation to have them disconnected? The first question would compel the company to extinguish all light and power in a district, regardless of the necessity of so doing, or be held liable for any consequences that might follow its failure. It takes no account of the fact that by so doing in the case of a night fire, a district would be left in complete darkness, and that, following an alarm of fire, panic might ensue in hotels and residences, and that the resulting damage might far exceed that which the extinguishment of the lights was designed to prevent.

In considering the second question, it may be stated that it is not negligence on the part of the company because it fails to have an employee attend all fires and charging this employee with the duty of disconnecting certain wires or signalling for the disconnection of the district.

However, any reasonable ordinance containing provisions of this character, would be upheld, and if the electric company failed to live up to the terms of the ordinance, and injury resulted, the company would be guilty of negligence. But where there is no such ordinance the company could not be held to perform this work.

In the case of New Omaha Thomson-Houston Electric Light Company versus Anderson, 73 Neb., 84, where an ordinance required electric companies to send one or more competent linemen to fires, to report to the city electrician, and remove or disconnect wires where directed, the court held that this imposed no further duty than that of so doing, and that the company was not liable, even when it was shown that the company's linemen invited the firemen to proceed to lower the ladder, declaring the wires with which it thereupon came in contact, and which proved to be heavily charged, were "dead."

However, to analyze the Pennebaker case a little more, if a mere onlooker (the company's employee) could see that the electricity was escaping in dangerous quantities from the wires,

surely Pennebaker himself knew this far better, for he was in the immediate vicinity of the wires, knew of the shocks received by the other firemen, and had even heard the discussion as to how dangerous it was. Surely Pennebaker was guilty of contributory negligence.

In Missouri there is a modification of this rule. It is held that the company is responsible where it fails to keep its wires in good condition when they are on public property, such as hanging over a street; and in case of a fireman on his way to a fire being injured by hanging or loose wires, the company would be responsible.

From all of this it is seen that the municipality seeks to eliminate the electric current as a fire cause, and in the practical operation of the rules and regulations nothing is more reasonable. Good, strict regulation in the installation of wires and equipment can never be objected to by honest people, and reasonable regulations concerning the conduct of the company after installation are just as important. But the rules governing companies at fires are worked out in a perfectly satisfactory manner. In the Pennebaker case, at first glance, it looks as if the company were negligent, but on analysis of the matter it is seen that the company was not only not negligent but that Pennebaker was negligent. Electric companies, no matter how operated, can never endow certain people with sufficient intelligence to know when they are in danger.

Pay-Within Patent.

In the suit brought by the Prepayment Car Sales Company against the Pittsburgh Railways Company for infringement of patents on the pay-within car a non-suit has been entered. The Pittsburgh Railways Company had installed a prepayment method of its own under license granted by P. N. Jones, who was the inventor of an automatic door and prepayment-car platform. The plaintiff company represents a combination of the Pay-Within-Car Company, the Pay-As-You-Enter Car Corporation and the Pay-On-Platform Car Company.

Public Service Commissions

NEW YORK.

That the accident to the New York Central's Twentieth Century Limited at Hyde Park on March 13, 1912, was due to an irregularity in superelevation of the outer rail, or what is more commonly known as a low spot in track, and not to a broken rail as was generally supposed, is the finding of the Public Service Commission, Second District, as the result of a most thorough investigation of this accident. In connection with its report on this accident, the Commission goes strongly on record in favor of a reduction in the speed of passenger trains, especially in the winter season. The Twentieth Century in this accident was derailed while running at high speed: four cars went down a 10-foot embankment into the Hudson River, where they were stopped by heavy ice. A total of 73 passengers and employees were injured, all slightly. The report states that the breaking of the rail referred to appears to have been the result of the accident and not the cause.

The Public Service Commission, Second District, has authorized the Elmira Water, Light and Railroad Company to issue its consolidated mortgage five per cent 30-year gold bonds to the amount (par value) of $201,000. The bonds are to be sold at not less than 87.

The Commission has authorized Harry E. Huver to exercise a franchise granted him by the village of Kenmore, Erie County for the furnishing of natural gas to that village. The petitioner at the present time has no supply of natural gas but proposes to bore for gas in the vicinity of Kenmore. The application to supply natural gas to the village was opposed by the Buffalo General Electric Company, which has a franchise in the village of Kenmore to supply electric current. In its resolution the Commission says it does not think that the considerations brought forward by either of the objecting corporations ought to weigh in this case. The village has, after careful consideration, made a contract which is satisfactory to it and which will, if natural gas can be found, assure to it a supply of that very necessary commodity at prices which seem to it adequate. The objections of an electric light company or manufactured gas company under such conditions ought not to prevail.

The Commission has given its approval for the Newfane Electric Company to exercise a franchise for the furnishing of electricity in the town of Newfane, Niagara County, and has authorized The Depew and Lancaster Light, Power and Conduit Company to exercise a franchise for the serving of electricity within the town of Alden, Erie County.

The Commission has denied the application of the Lewiston and Lake Ontario Shore Power Company to exercise franchises in the town and village of Wilson, Niagara County. The application was denied for the reason that the Conant-Bryant Power Company is at present doing business in the village of Wilson, and also has a franchise from the town of Wilson. The Lewiston and Lake Ontario Shore Power Company, however, was given permission to renew its application unless the Conan-Bryant Power Company presented to the Commission, at a hearing to be held at Buffalo on August 2, proof that it has entered into a contract with the Niagara, Lockport and Ontario Power Company for the purchase of Niagara power so that it will be able to supply any call for power in the town and village of Wilson; also that it has actually begun the construction of its transmission line.

MASSACHUSETTS.

The Fall River Gas Works Company has appealed to the Supreme Court to set aside a recent order of the Gas and Electric Light Commission refusing authority to issue additional capital stock. It was held that the issuance of additional securities would be an unnecessary burden upon the public.

The Commission has issued an order fixing the price of the magnetite arc lamps used for street lighting in the city of Worcester. The rate to be charged by the Worcester Electric Light Company is fixed at $80.30 per year per lamp. The rate formerly charged by the company was $91.25. These lamps are run on an all-night schedule. The city contended for a price of $64.83, while the company maintained that the cost of service was $91.94 when all charges were taken into account. Owing to the fact that this

service is not independent of the commercial service furnished by the same company it was impossible to entirely separate the items of cost. The commissioners held that the price charged for street lighting cannot and should not be fixed without taking into account the conditions surrounding the entire business of the company.

Emergency Telephone Service for Trucks.

Because of numerous accidents to auto trucks caused by fire recently, B. F. Laudig, of Scranton, Pa., has submitted to the Bell Telephone Company a plan which he believes not only will increase the revenues of the company and augment the efficiency of the telephone, but will make for safety on the roads and save the wages of a second man on all delivery wagons and trucks. He has worked out his plan with some attention to detail. He proposes that all telephone routes shall be equipped with cut-in switches attached to every sixth pole, placed high and protected from the weather by suitable covering. Portable telephones specially prepared for use at these cut-ins are to be carried by all trucks and wagons owned by firms making use of this system. In event of an accident, the driver merely walks to the nearest pole station and from there establishes instant communication with his employer. To prevent abuse, Mr. Laudig proposes that these portable telephones be numbered in serials and that those permitted to use them be given a code word which will establish their identity with the operator making the connection and thus the telephone company will be assured of its tolls and the patron will be protected from the misuse of his 'phone and number.

Pennsylvania's Coal Production.

The production of bituminous coal in Pennsylvania in 1911 was 5,800,223 short tons less than it was in 1910, and this decrease represents almost exactly the decrease in the total production of coal for the United States. The decrease in Pennsylvania was furthermore almost entirely in that portion of the product used in the manufacture of coke. The final figures for Pennsylvania, as compiled by E. W. Parker, of the United States Geological Survey, show that in 1911 Pennsylvania miners produced 144,721,303 short tons of bituminous coal with a spot value of $146,311,930. In addition to this the anthracite miners produced 90,464,067 short tons of hard coal, valued at $174,952,415, the combined figures of production and value being respectively 235,185,370 short tons and $321,264,345.

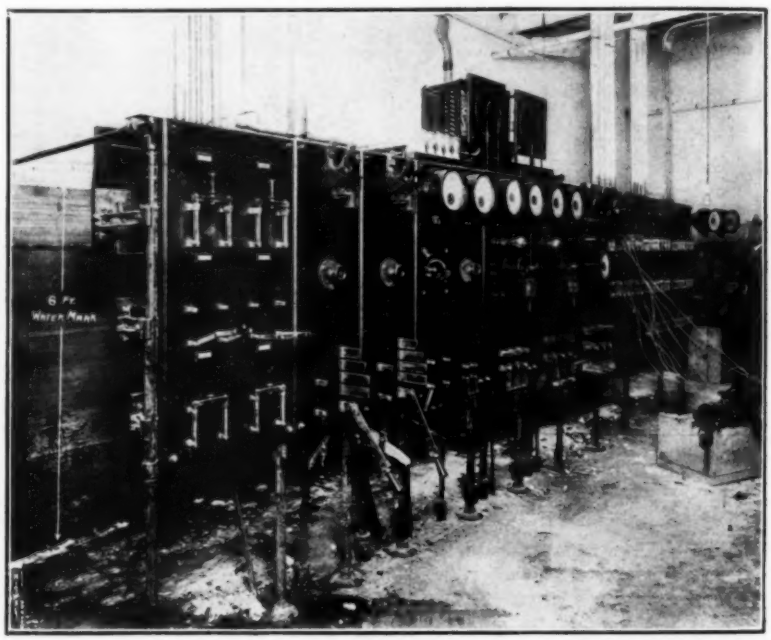
Central-Station Service in the Denver Flood.

Convincing proof of the reliability of central-station service was recently strikingly demonstrated in Denver. There is a small stream flowing through the heart of the city known as Cherry Creek. At intervals this creek goes on a rampage and what was formerly a small muddy stream, with scarcely any water in it, becomes a raging torrent due to the accumulation of rain waters in the section southeast of Denver for which the creek forms a drainage.

The Denver City Tramway Company's new car barns and office buildings are situated about 500 feet from the north bank of the creek. In this station the traction company has a private lighting plant for converting the voltage used on the street-car system to a voltage suitable for lighting the barns and the office building. About three weeks ago a cloudburst in the district southeast of Denver sent a tremendous volume of water down the creek. It reached Denver about nine o'clock on Sunday night, July 14, at a time when the equipment in the barn was in full operation. After some time the water coming down the creek reached a volume which the banks were unable to contain. It gradually overflowed and rapidly made its way to the tramway company's barns. The result was that the barns and the apparatus were inundated. The switchboard and motor-generator sets were covered with water of a depth of six feet, and in some places in the barns it was deeper.

Fortunately the company was prepared for such an emergency, as a throwover switch connecting the building with central-station service had been installed. At first the water covered the floor for only a depth of about two feet and there seemed to be no danger of having to shut down the plant. However, a few blocks further down-stream a bridge which was rather low became clogged up with the débris brought down by the water. This resulted in forcing the water back up-stream and after a time it spread out in all directions, even flooding Sixteenth Street and numerous cellars on other streets.

It is probable that the plant would have been kept in opertaion but for the tact that a door leading from the main portion of the car barn into the switchboard and motor-generator housing was forced in by the weight of the water, which had grown to quite a depth. When this occurred the engineer in charge of the lighting apparatus threw the throwover switch, making a connection with the lines of the Denver Gas & Electric Light Company, and made his exit through a coal chute. In about fifteen minutes the entire equipment was submerged in six feet of water.



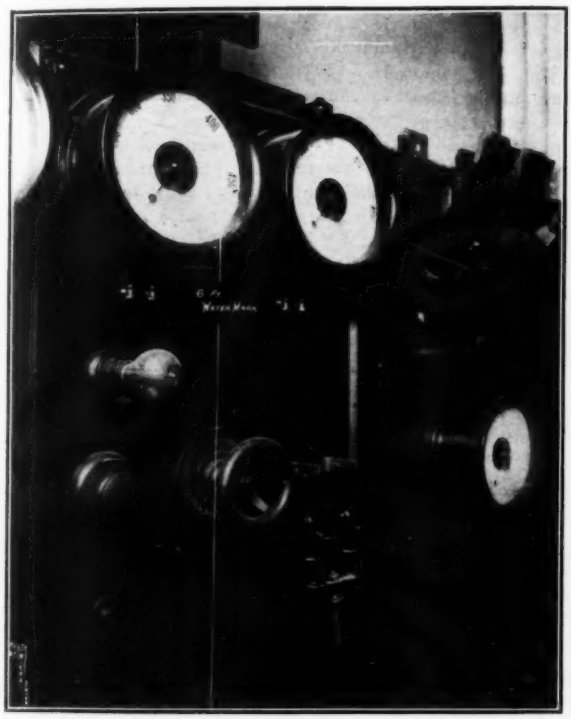
Denver Tramway Company's Switchboard After Flood.

Although the throwover switch was under this water for a period of three days there was no interruption to service. Without light for their office buildings the tramway company's office force would have been compelled to discontinue work.

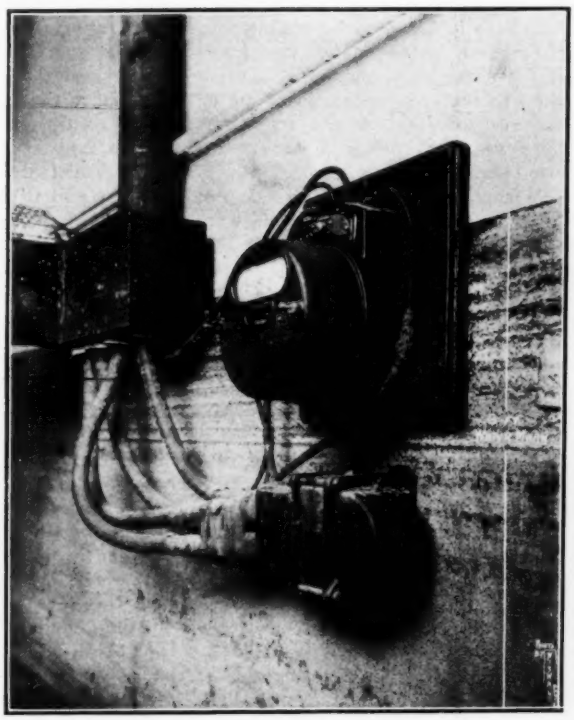
In the accompanying illustrations the

white lines indicate how deeply the apparatus was submerged. Along the gray cement wall in the photograph of the switchboard the marks left by the mud after the water had receded, or had been pumped out, can be seen.

In the photograph of the switchboard at close range is shown the marks left by the water on the face of the ammeter and the white line in this picture indicates the depth of the water. The Westinghouse meter shown in the last illustration was also covered with water, and although several inches of it were found in the meter it did not fail to record the current consumption. Later this piece of equipment was taken out and tested and there seemed to be no ill effect from the muddy water.



Switchboard at Close Range, Showing Marks Left by Muddy Water.



Watt-Hour Meter Which Registered Through the Flood, Although Submerged.

It is said that in some places the water covered the ceiling drop cords for about three inches. In these instances the water was seven feet deep.

This flood plainly demonstrated that a private lighting plant is unreliable and it also showed that the manufacturers of present-day electrical equipment have put quality into their product, as the equipment was apparently undamaged. If it had not been for the foresight of the tramway officials in being prepared for just such a case, and having the emergency service installed, business operations in the office department would have had to be suspended. At any rate, the Denver Gas & Electric Light Company is furnished with a strong weapon which it will use effectively against the installation of private lighting systems.

The company was able to make quite an earning due to the disastrous flood. About two hundred cellars in the vicinity of Cherry Creek were filled with water.

The city administration urged all property owners to have the water removed as quickly as possible to guard against the spread of contagious diseases. The electric pump offered the best and quickest means for the removal of the waters, and during the days immediately following the flood the electrical supply houses having them in stock did a thriving business renting the pumps.

The Denver Gas & Electric Light Company equipped one of its 750-pound General Vehicle electric trucks with a pump and motor and was able to do considerable work which netted quite an earning. Power for running the motor was secured by tapping on the company's lines at convenient places.

In the famous marble quarries at Carrara, Italy, electric power has rapidly replaced nearly all other sources of power. A recent statement of the power employed in these quarries gives the following figures: electric, 635 horsepower; hydraulic (five small plants), 70; steam, 42; gas, 168; and oil, 81 horsepower.

The Telephone and Forest Fires.

The value of the telephone in the protection of forests from fire losses is well known, although actual figures bearing upon the subject are somewhat scarce. According to State Fire Warden Hutchins of Massachusetts, who is in charge of a system of protection made available by a recent legislative appropriation of $10,000, the losses thus far reported from forest fires in 1912 total only $30,000 compared with about $502,000 in the same period last year, when the present protective system was not in operation. Fourteen observers are paid to occupy exposed posts equipped with telephone service, each station covering an area of about 30 miles in diameter. As soon as a fire is discovered, the watcher notifies the fire warden in the nearest town, who has authority to set citizens at work upon the blaze, in the absence of a regular fire department. Out of 1,100 forest fires thus far discovered in the state this year, from 800 to 900 have been first seen by the observers at the telephone stations. The work has been so thoroughly done that the Post Office Department at Washington has issued an order requiring all rural-delivery and country-mail carriers to cooperate by reporting fires to the nearest warden. This adds a patrol of about 600 men to the observing force above mentioned, and with the aid of electric communication enables many miles of highway to be covered daily.

THE CONSTRUCTION AND EQUIPMENT OF A MODERN SUBSTATION FOR THE DISTRIBUTION OF ELECTRICAL ENERGY.—I.

By Alden W. Welch.

The purpose of this article is to deal rapidly and accurately with the course of construction and to give dependable figures concerning the equipment of a substation of a lighting and power company. The substation is to supply two-phase current for lights and motors and continuous current for city arc lamps.

The load to be carried by the new station is at present handled by the nearest substations of the company. The amount of load to be lifted from their lines is found to be sufficient to warrant the installation of two 1,000-kilowatt frequency changers. In addition to these, arrangements must be made to pick up 120 city arc lamps which require continuous current for their operation.

To solve such a problem it is not necessary to attack it as if this were the first substation ever erected. This would necessitate a loss of time and materially increase the cost of the work, while the advantages accruing would be of a negative order as the only way to advance efficiently is to base the work upon actual experience and to call upon theory only where experience weakens. Theory is very necessary, for it shows how to do a thing in a new way, but the necessity for a new method should be prompted by experiences of failure with or possibilities of improving upon the old.

Hence from experience with like problems an estimate of the cost and other main features of the new one can be obtained. Before making any estimate, the territory to be supplied must be carefully considered. The fact that a station is required means that the immediate load to be expected is considerable. To this add the estimated increase at the end of ten years and an idea of the size of the building to contain the necessary equipment for handling this load can be calculated.

For all important pieces of work a verbal understanding is not sufficient. A specification should be prepared by the engineer of the company which will contain clear and concise statements under unmistakable headings of the work to be performed. When the drawings and specifications have been prepared they are sent out to contractors or manufacturers, as the case may be, for estimate. From the estimates an idea of the cost of the work can be determined and a working order applied for. When this has been granted the contract is let and work started as soon thereafter as possible.

Building.

The preparation of the drawings and specifications for the substation building is a labor that must be performed with care and when finished by the draftsmen, carefully checked by the engineer before being approved. This is necessary as the construction business is a close game and the contractors who have made a success of it are those who grasp the opportunities which come their way. One form of opportunity is the error of commission or omission appearing in a specification. One clause which has been found of value to the party of the second part is that which states that the drawings and specifications are to be considered as co-operating. The work shown on the drawings although not mentioned in the specifications, or vice versa, but essential to the proper accomplishment of the contract, shall be performed as if both fully specified and shown. A complete list of drawings giving both numbers and titles should be inserted.

A visit by the contractor to the scene of the future building should be insisted upon by the engineer so that he may satisfy himself as to the present conditions. This will minimize future disputes.

The contract for the erection of a certain substation building which I have in mind did not include the construction of the foundations, pits for machine foundations and for manholes. This work was performed by the company at a cost of $4,000. All duct work below the main floor was installed by the company at a cost of $600. The inspection expense for all this work was $150. The work of the building contractor began about one foot below the floor line and consisted of carrying the construction work from this point as thereinafter specified by the company.

The cast-iron columns for the support of the gallery should be made of the best grade of gray iron, and should be free from all defects.

On the foundation walls provided by the company, the contractor is to construct the walls of the building which are to be of brick. In this connection the specifications should explain the manner of laying up the brickwork. The bricks must be bonded and bedded with all crevices and joints slushed with mortar. Walls must be plumb and true. Joints to be flushed and of uniform thickness not to exceed 0.38 inch. Bricks to be clean and wet just before using so that a good bond may be obtained between brick and mortar. After the completion of the brickwork, all walls, inside and out, must be thoroughly washed down with acid and left clean and neat.

The sills and lintels should be specified. Bluestone gives an attractive appearance. A sill should be provided for the main entrance door. The building law requires a three-foot parapet. For the sake of appearance it is well to specify a stone coping for the front parapet. The parapets on the other walls should be capped with vitrified tile. Flashing between the parapets and the roof should be of copper, 16 ounces to the square foot. The tile coping should have overlapping joints with all joints pointed with cement mortar.

The cement mortar used in laying the bricks should be composed of one part best American Portland cement to three parts of sand. The mortar for the outside courses may contain in addition slaked lime and coloring matter. This will give a neat appearance to the walls.

All concrete except that for the roof and bus compartments should be a 1 : 3 : 5 mixture, the stones having a maximum dimension of 0.75 inch. The concrete for the roof should be a 1 : 2 : 4 mixture. The method of mixing this concrete should be thoroughly explained.

The contractor is to furnish and place all steel trusses for the roof and monitor, or superstructure, and all other steel work including floor beams of gallery, bearing plates, anchors, etc. The character of the steel, i, e., its freeness from all defects, the making of rivet holes, i. e., by punching, and the riveting should all be explained. All the steel work is to be cleaned and then painted with a priming paint. The paint should cost at least 75 cents per gallon. It is well when two coats are to be applied as in the case of steel work, to use different colors so that any abrasions in either coat may be detected.

The construction of the floor and roof arches should now be specified. The whole floor and the pits under the bus compartments should be finished with a "granolithic" finish, 1.5 inches thick. This finish is composed of one part Portland cement to one part sand to two parts of blue-stone screenings. Where the last ingredient cannot be obtained some other stone may be substituted. This finish can be colored to suit with lampblack. The floors may be marked off in squares.

The flashing and drainage should now be explained, after which the type of roofing may be specified. A good roofing may be obtained by the use of five-ply roofing felt covered with slag or cinders. This should be guaranteed for five years. The monitor is, of course, equipped with an iron and wire-

glass skylight including all necessary operating levers.

A cornice should be furnished for the front elevation and securely fastened to the brickwork. The door and window frames complete with doors, windows, and all accessories should be specified. An iron gate should be provided for the main entrance. It should be stated where window screens are required.

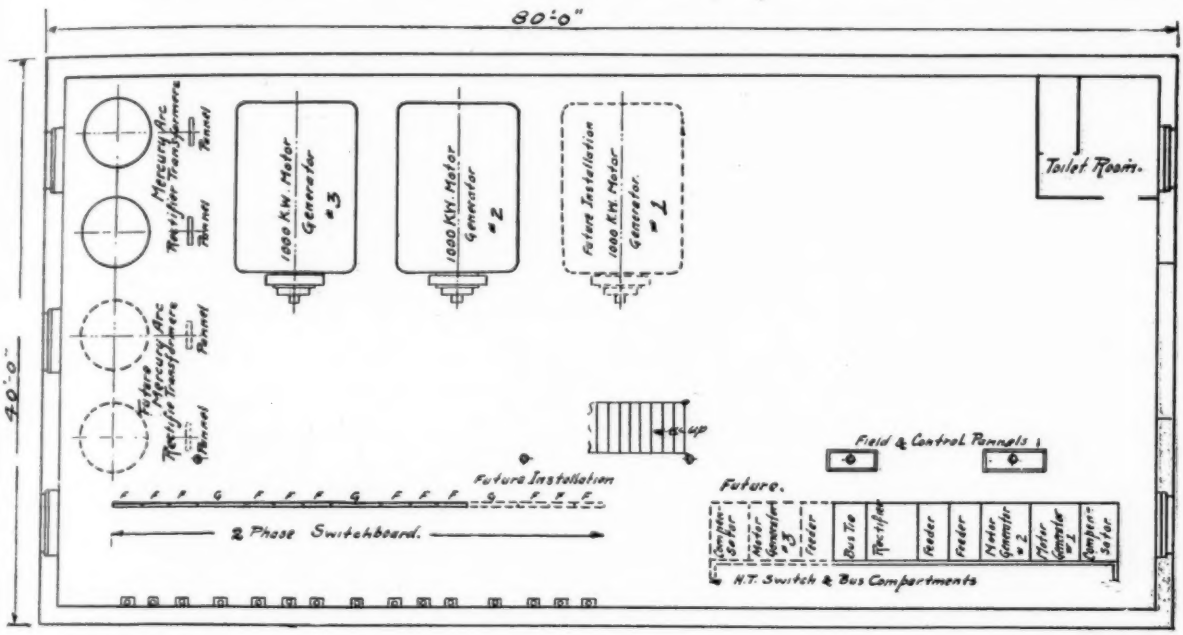
The contractor should construct a full-width sidewalk in front of the building if necessary. A good sidewalk is obtained by laying 6 inches of concrete over an 8-inch bed of clean wet cinders. A "granolithic" finish or its equivalent is laid over this.

A ladder and scuttle must be provided for access to the roof. A toilet room must be provided as per drawing. In the case I have in mind, the policies of which I am to some extent following, the building contractor was not called upon to furnish the plumbing, but was asked to co-operate with the plumber in the matter of leaving holes where required and to fill in and finish around pipe after installation.

The building contractor will also construct the concrete high-tension switch and bus compartments, including the placing of all fiber ducts and ironwork. Great care must be taken in the placing and alinement of the switch walls so that the finished work will agree with the dimensions given on the drawings. An error of two inches in the height of a certain compartment which I have in mind, made it necessary to have special rods constructed for the oil switch which was to be installed therein. Recesses must be left for the placing of asbestos barriers and cover. The latter should be provided and placed by the contractor. Openings must be left in the walls for the insertion of porcelain-tube insulators provided by the company. All panels for the compartments are furnished and erected by the contractor and in this connection I would recommend black slate or alberene stone as panel material. Also asbestos doors are provided for the lower fronts of the compartments by the contractor. He shall also furnish and erect the brackets, angle iron and flat iron for the support of the series and potential transformers.

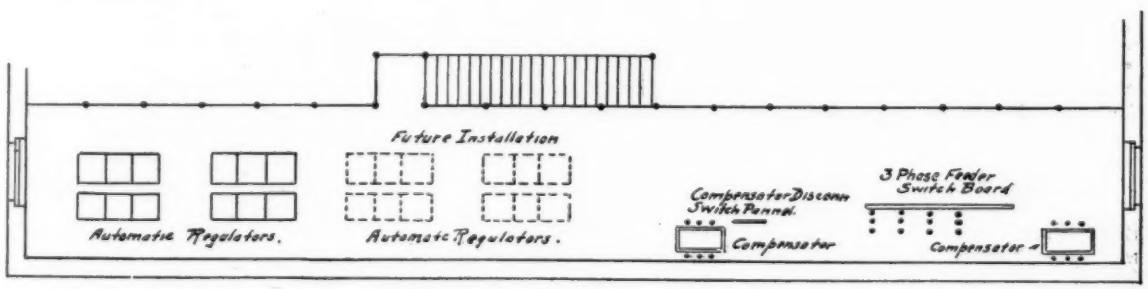
The concrete for the compartments is to be composed of one part Portland cement, two parts sand and four parts 0.75-inch broken stone. The concrete slabs used as barriers for the compartments are to be made of one part Portland cement to two parts of sand and reinforced with wire cloth of No. 12 gauge with a mesh about three inches square, the reinforcement to be set at the center of the slabs.

After the masonry and brickwork have, in the opinion of the engineer, dried sufficiently, the whole area within the building, including the switch and bus compartments, all brick and



F. Feeder Pannel.
G. Machine Pannel.

Plan of Main Floor



Plan of Gallery

Fig. 1.—Plan of Substation.

plaster walls, under side of floor and roof arches, etc., are to receive one heavy coat of sizing paint and three coats of linseed paint. All iron work should receive two coats of the latter paint, in addition to the coat before specified.

The actual cost of waterproofing the walls will be $100. This work should be done by first applying a coat of shellac to prevent the black of the waterproofing from setting through the finished coat. In fact the contractor is to leave the whole job in a finished state, ready for the introduction of the electrical equipments.

I have dwelt rather at length upon the building specifications, and, I believe, justly. They are important and their general scope and wording should be understood by the engineer before he attempts to write them so that the contractors who read them will know exactly what is required.

The complete specifications and drawings are sent out for estimate to as many contractors as desired. When the bids are received and the cost of the building is known, a working order application is made out by the engineer for authorization to spend this money. A working order for the erection of a substation along the lines specified in the foregoing would embrace the following items:

(*A*) Excavation, piling and concrete foundations for building	$ 4,000
(*B*) All ducts below main floor	600
(*C*) Inspection for (*A*) and (*B*)	150
(*D*) Building Contract	10,000
(*E*) Plumbing	600
(*F*) Inspection for (*D*)	300
(*G*) Incidentals	400
	$16,050

Item *G* is important, as very few jobs of this character can be completed satisfactorily without the addition of some extras. Developments occur which may make desirable some change in or additions to the original plans and specifications. It is more satisfactory to have such a leeway, in the above case 2.5 per cent of the total cost, than to have to apply for a small extension to the appropriation.

All the work of construction should be carefully followed up by a competent inspector reporting to the engineer. Such a man can be procured at a salary of $25 per week. The estimate shows two items for inspection, (*C*) and (*F*). It is interesting to know what the inspection actually cost. The time consumed in the excavation and building of the foundations was 10 weeks. The inspection of this work was intermittent and cost $115. The building contract was completed in 8 weeks and the inspection occupied the full time at $25 per week amounted to $200.

A water meter was installed on the job for the purpose of billing the contractors correctly for the water used in the work. The water used in the concrete for the foundations cost $30. or 0.75 per cent of the total construction cost. That for the walls, etc., amounted to $20 or 0.2 per cent of the total cost.

A telephone was installed on the site of the station for the use of the company and the contractor. This made it easy for the engineer to keep in touch with his inspector on the job. It was also a convenience for the contractor, who should pay half of the expense. The simplest method of taking care of this without friction is for the company to charge all expense against the working order and bill the contractor for his share at the completion of the work. When the building is finished the telephone can be transferred into a booth inside. A No. 40 golden-oak, sound-proof telephone booth as manufactured by the Western Electric Company costs about $56.

Fig. I shows a plan of the general layout of the station. The overall dimensions are 40 feet by 80 feet. The 6,600-volt, three-phase switch and bus compartments occupy the northwest part of the station, while the 2,400-volt, two-phase switchboard is situated in the northeast part. The toilet occupies the southwest corner. The two 1,000-kilowatt synchronous frequency changers should be placed on the south side toward the rear, thus leaving room for future machines. It will be much easier to place such new machines as shown in Fig. I than to have to move them past the present ones, as would be necessary if these were installed in the front of the station.

In the rear are the mercury-arc rectifiers, one of which is of the General Electric type while the other is of Westinghouse make. There are three 4-by-8-feet windows in the rear and two in the front, one on each side of the entrance, which is 11 feet wide.

The two-phase feeders leave the station at the rear of the switchboard and are spaced 2 feet apart. The arc circuits have the same plan of position and are placed as near to the rectifiers as possible. The high-tension feeders enter the station back of the three-phase switchboard.

The two-phase regulators are situated in the gallery. The figure shows that twelve will be installed immediately to take care of six feeders while space is reserved for the addition of a like number when the load warrants it.

(To be continued.)

The United States has become a half-billion-ton coal country. During the last two years the total production has averaged just a trifle short of the 500,000,000 mark, exceeding that figure in 1910 and almost reaching it in 1911.

CANADIAN GOVERNMETAL CONTROL OF NIAGARA ELECTRICITY—III.

By Frank Koester.

Niagara power is distributed in Ontario by the Hydro-Electric Power Commission of the Province of Ontario.

It is a board of three officials created May 10, 1906, by the legislature of the province, and its members are appointed by the lieutenant-governor in council. The present incumbents are Adam Beck, London, Ont., the leading spirit of the whole proposition from its inception; John S. Hendrie, Hamilton, and W. K. McNaight, Toronto.

While none of these members were even connected with any electrical undertakings, they obtained the services of an able electrical engineer of international reputation, P. W. Sothman, in whose hands was placed the entire charge of the whole installation.

The question of the utilization of Niagara electricity was one of great popular interest from the time when it was seen to be becoming a possibility, and the government early took steps to insure its control of the situation.

The Hydro-Electric Power Commission is, in a legal sense, the trustee of the system, holding it for the benefit of the 14 original cities which entered into the agreement, to which additional cities have and will adhere from time to time, it being the intention to expand it to meet the requirements of all the cities of the province, westward to Lake St. Clair and northward to Georgian Bay.

Each of the participating cities receives its power at a certain contracted rate varying from $18.10, in the case of Toronto, to $29.50 in the case of St. Mary, the rate being based on the amount of current used and the distance which it is transmitted.

Each of the participating cities has charged against it its own share of the cost of installation, the funds for the purpose having been obtained by the sale of bonds, which mature in 30 years.

The Commission obtains its power at the Falls at $9.40 and the difference in price between the cost and the price at which it is sold to the cities is so adjusted that it covers all operating and overheard charges, including sinking fund on the bonds, so that the price paid by the cities represents the true cost as nearly as possible, without any profit, the Commission not being organized for the purpose of profit.

In addition, the cities have to install their own local distributing systems or utilize those already in existence, which they take over at a valuation. This is an important part of the ultimate cost of the power.

The price paid by the Hydro-Electric Commission to the Ontario Power Company is $9.40 per horsepower per annum, up to a quantity of 25,000 horsepower. Figuring on a 20-minute peak load, when more than 25,000 horsepower is received, the price is reduced to $9 per horsepower per annum for all the power. The current is supplied at 12,000 volts, three-phase, 25 cycles, and is stepped up to 110,000 volts in a substation of the Hydro-Electric Commission located near the distributing station of the Ontario Power Company.

The transmission system of the Hydro-Electric Commission begins with the transformer station at Niagara Falls, with a present transformer capacity of 27,000 kilowatts; it takes the power on delivery at 12,000 volts; thence, a 60,000-horsepower double-circuit transmission line of 110,000 volts conveys the current to a controlling station at Dundas, whence the line is continued east to the city of Toronto, with a local transformer station at Port Credit. From the controlling station at Dundas a single line of the same capacity and voltage is continued via Woodstock and London to St. Thomas, with local transformer stations at these points. From the same central controlling station at Dundas a similar line proceeds north and west, via Guelph, Preston, Berlin, Stratford and St. Marys to London, with local transformer stations at each of these points, the whole high-voltage line thus described comprising 281 miles.

The 110,000-volt pressure is stepped down to 13,200 volts to supply local distributing stations at the following points, the installed transformer capacity being given for each station:

Dundas	2,250 kilowatts
Toronto	7,500 kilowatts
London	3,750 kilowatts
Guelph	2,250 kilowatts
Preston	2,250 kilowatts
Berlin	2,250 kilowatts
Stratford	2,250 kilowatts
St. Marys	2,250 kilowatts
Woodstock	2,250 kilowatts
St. Thomas	2,250 kilowatts
Port Credit	3,750 kilowatts

The municipalities of Toronto, Hamilton, Bradford, Galt, Stratford, Woodstock, Guelph, Waterloo, London, St. Thomas, St. Marys, Hespeler and New Hamburg, in January, 1908, submitted by-laws authorizing the raising of funds to cover the cost of a distributing system for the energy purchased from the Commission. Ingersoll contracted with the Commission at a later date. The commission entered into an agreement the succeeding May to supply energy to the municipalities as follows:

Toronto	10,000 horsepower
London	5,000 horsepower
Guelph	2,500 horsepower
Stratford	1,000 horsepower
St. Thomas	1,500 horsepower
Woodstock	1,200 horsepower
Berlin	1,000 horsepower
Galt	1,200 horsepower
Hespelar	300 horsepower
St. Marys	500 horsepower
Preston	600 horsepower
Waterloo	685 horsepower
New Hamburg	250 horsepower
Ingersoll	500 horsepower
	26,235 horsepower

Since that date (May) the following municipalities have contracted with the Commission:

Hamilton	1,000 horsepower
Tilsonburg	500 horsepower
Brampton	1,300 horsepower
Weston	250 horsepower
Dundas	600 horsepower
Seaforth	400 horsepower
Mitchell	200 horsepower

The proposition is under consideration in other municipalities, as will be seen later on.

The following table gives the estimated maximum cost of power in the municipalities under the condition that the amount of power contracted for is used: Column "A" gives the quantity applied for in horsepower. Column "B" gives the estimated maximum cost of power ready for distribution to the municipalities. Column "C" gives the estimated proportionate part of cost to construct transmission line, transformer stations, and works for nominally 30,000 horsepower with total capacity of 60,000 horsepower. Column "D" gives the estimated approximate part of line loss, cost to operate, maintain, repair, renew and insure transmission line, transformer station and works for nominally 30,000 horsepower, with a total capacity of 60,000 horsepower.

Municipalities	"A"	"B"	"C"	"D"
Toronto	10,000	$18.10	$828,080	$38,970
London	5,000	23.50	671,089	31,578
Guelph	2,500	24.00	347,420	16,350
Stratford	1,000	27.10	173,580	8,120
St. Thomas	1,500	26.50	244,140	11,490
Woodstock	1,200	23.00	155,350	7,310
Berlin	1,000	24.00	138,970	6,540
Galt	1,200	22.00	143,920	6,773
Hespeler	300	26.00	63,200	2,974
St. Marys	500	29.50	95,677	4,502
Preston	600	23.50	80,530	3,789
Waterloo	685	24.50	98,460	4,630
New Hamburg	250	29.50	47,830	2,251
Ingersoll	500	24.50	69,485	3,270

The muncipalities agreed to pay the Commission for the power which they purchase, delivered at the municipal stations at 13,000 volts, on the following basis, viz:

The contract price of the Ontario Power Company at Niagara Falls plus:

(1) Four per cent upon that part of the construction cost which is properly applicable to each participating municipality, plus:

(2) An annual amount sufficient to create a sinking fund which in thirty years shall completely pay for that portion of the construction cost which is applicable to each municipality, plus:

(3) That proportion of the line loss and the general operation and maintenance charges which is properly applicable to each municipality.

Each municipality assumes the responsibility for acquiring or providing the necessary local distributing system, and the maximum cost to the consumer will be the above charges made by the Commission plus the respective local distributing costs.

The foregoing figures are based on the use of a given amount of electricity contracted for by each of the cities. Since, however, their consumption has not as yet, in any case, reached the amount contracted for, a higher rate is being paid. In Toronto the actual rate is $18.50; while not greatly higher than the contracted price of $18.10, in London, the rate is $28 as compared with a contracted price of $23.50; in Ingersoll $28, as compared with $24.50; and in Stratford, $32 as compared with $27.10.

Electric Fans in India.

There is a steady increase in the sale of electric fans in the principal cities of India. The Madras Electric Supply Corporation Limited, a British company, has sold more than $30,000 worth. During the last six months of 1911, 476 fans were sold and this year down to May 3 a further 676. The Calcutta Electric Supply Corporation, another English-owned concern, has a very large fan business on its circuits, including churches and other public buildings. The Indian palaces and mansions of princes and other native notabilities form one of the finest classes of electrical installation customers. In Bombay, Delhi and other cities, experience will be similar to that of Madras and Calcutta in the fan trade; indeed, India as an electrical market is growing in importance every year, large as the electrical imports have been.

New Electrical and Mechanical Appliances

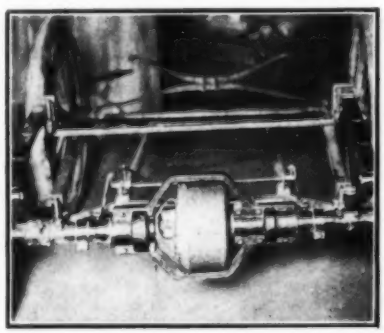
The Dey Electric Automobile.

Any one who has given careful observation to the traffic in the narrow and congested downtown streets of our largest cities cannot but appreciate the advantages to be derived from a vehicle that is driven and steered by all four wheels. With such an arrangement turns can be made within one-half the radius, thus allowing a vehicle to turn around in any street wider than an alley without recourse to backing; and for the same reason, and also because the wheels track with one another, passage can be made through narrow crooked openings between vehicles that would otherwise be prohibitive. Another good feature of vehicles of this type is that they are absolutely non-skidding, so that when making fast time, dodging in and out, they are absolutely sure of their "footing"; and with brakes applied to all four wheels, which is becoming universal practice in England, stopping can be accomplished in one-half the customary distance.

Another advantage of this type is that backward steering is as easy as forward which makes it very convenient for getting out of "pockets." This brings up the question: Why not locate the seat over the center of the body? The steering post and linkage do not necessarily have to pass down through the latter. The seat can be mounted to swivel around the post, the controller moving with it. This would make a typical ferry-boat arrangement that can be loaded and unloaded from both ends, and operated in either direction. Steering can be gauged much better from this location than when the seat is farther forward and the elevated position gives a very commanding view. When one considers the time saved in maneuvering for loading and unloading positions, wriggling through obstructed traffic and backing out of pockets, it seems that this type of vehicle should become very useful.

Harry E. Dey, of 303 Arlington Avenue, Jersey City, N. J., has invented an automobile that may be made to combine any or all of the above features. It is claimed to be the ideal of simplicity, and cheaper to construct than any vehicle now upon the market. Higher electrical and mechanical efficiency are also claimed, as well as a number of other advantages, some of which will appear in the following description.

The motor is located in the center of the axle, the middle portion of the latter spreading apart to receive it, and the center lines of the two being coincident. This motor is a special design in which the field magnet and the armature of the motor both rotate. One element is connected by means of a new mechanical reducing mechanism, to one wheel, while the other element is attached in a similar manner to the opposite wheel. As the elements rotate in opposite directions, the mechanism has to be designed so as to reverse the direction of the motion in one case, while in that of the other it remains unchanged. This is accomplished without any addition to the speed-reduction parts. The device has been broadly



Chassis of Dey Electric Automobile, Showing Arrangement of Motor.

covered in the United States Patent Office as a new mechanical movement, proving that it is absolutely new in mechanics. It has been thoroughly tested upon a gasoline car and has shown remarkably high efficiency in practice as well as in theory. It is as silent as a worm drive, but there its resemblance ceases. Particulars of this mechanism are withheld by the inventor, because publicity would interfere with the obtaining of foreign patents.

As the motor elements are separately connected to the wheels, no differential gears are required, the motor taking care of the unequal requirements of the wheels in a manner superior to any differential gear. The desirability of getting rid of this expensive, heavy and often troublesome piece of mechanism cannot be gainsaid.

The motor, on account of the rotation of both elements and other unusual features of design, weighs approximately one-third as much as the present standard vehicle motors of the same capacity, and its long-time overload ability is said to be unapproachable. This is accomplished by having the armature in the form of a ring, outside the field, and fully exposed to the air in which it is rapidly rotating. It is, however, fully protected from the elements. The inventor has one of these motors weighing forty-seven pounds that is rated at two horsepower and has repeatedly been subjected to temporary overloads of from 600 to 700 per cent without showing the slightest indication of abuse.

The motor and transmission may be removed in one minute, and replaced, ready for running, in the same space of time. This illustrates the simplicity of the construction. The steering knuckles are inside of the hubs, directly over the ground contacts of the tires, thus giving ideal steering conditions. The driving axles are of the floating type, and are connected to the wheels by means of ball-bearing universal joints that are very compact and above mechanical criticism.

It may appear like going backwards to revert to the reach-type running gear. The inventor says, however, that he sees so many points in its favor, and fails to find anything that can be legitimately brought against it, that he prefers to use it. His reach construction is entirely new in design, and provides a very flexible and strong running gear. The battery is mounted between, and supported by, the reaches through a two-point spring suspension. This is an ideal location for the battery, as it requires less power to propel it when carried midway between the axles; the jarring is reduced to a minimum from road shocks, and eliminated entirely from what may be still worse, the severe shocks from slamming heavy loads upon the body. The center of gravity is brought very low. The battery can be dropped to the floor for exchange or repairs, while for water filling and inspection the floor boards may be removed in the usual manner of underslung batteries. For pleasure vehicles the entire body is usable for passengers and luggage, with absolutely no fear of coming in contact with the acid or its fumes; and the body itself is not affected thereby.

The control is a new arrangement that combines all the advantages of the shunt motor as a current generator, to recharge the battery whenever the motor is acting as a brake, and the overload ability of the series motor; for it is interchangeable from one to the other by the mere pressure of a button. This plan does not involve any additional winding upon the field, there being only one field coil upon the motor. Brakes are applied to all four wheels, in a manner that is simple and takes care of their swiveling motion.

It is not Mr. Dey's intention to confine his inventions to four-wheel driving and steering, as they are just as applicable to the present standard type; and he claims that he has more indisputable talking points, even in the separate drive and steer arrangement, than in all other electric automobiles. There are many variable conditions to meet, as well as people of many minds, and it does not change the conditions of manufacture to any great extent to meet them all. For the front axles of single-motor equipments a radically new construction has been evolved. It is free from tie rods or other gimcracks. It has been tested out upon a gasoline car and has proved to be practically unbreakable, due to certain exclusive features. Mr. Dey claims that this will be as clean-cut a vehicle as ever came out of a shop, the only feature for criticism being the low-hung battery. This, of course, can be stowed away in the body if desired. The mechanism is so inconspicuous, however, as to almost make one wonder whether there is any.

A New Meter-Connecting Fuse Block.

A new design of meter-connecting fuse block has been invented by Robert Charles Cole, of Hartford, Conn. It is of very simple construction and greatly facilitates the testing of the meter, at the same time fully protecting it and the test instruments by means of fuses. It also permits the test to be made without any interference with the consumer's load circuits.

As shown in Fig. 1, the block, which is of porcelain or other insulating material, has mounted on it five adjoining pairs of clips for the reception of standard cartridge fuses. Beneath the lower fuse clips of the outer pairs are mounted transverse clips which permit cross connection of each outer pair by inserting another fuse or changing one about.

A method of connecting these wires for normal service is shown in Fig. 2 for a two-wire circuit. The meter is indicated by *M* with a series or current coil *39* and a pressure coil *40*. The fuses *34*, *35*, *36* and *37* thoroughly protect the line, meter and load from any overload or short-circuit. If a three-wire system is used, the neutral is connected through the middle terminals *30* and *32* and a fuse *38* is placed between them.

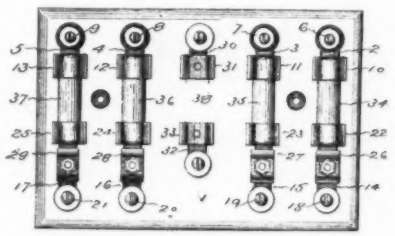


Fig. 1.—Cole Meter-Connecting Fuse Block.

Fig. 3 shows a method of connection for testing the meter without interfering with the consumer's load. By removing the fuses *35* and *36* and inserting them in the transverse clips, the consumer's load circuit is connected directly across the supply circuit and the meter temporarily short-circuited. A voltmeter *V* is connected to terminals *2* and *5*, that is, directly across the line. An ammeter *A* or portable testing standard and variable resistance are connected to the inner terminals *3* and *4*, that is, in series with the meter *M*, as can be seen by comparing Figs. 2 and 3. The test current is supplied directly from the supply source through fuses *34* and *37*, so that the test circuit and its instruments are protected. Mr. Cole has also invented a special connector for facilitating the connection of the instruments for test.

This fuse block was patented on July 9 and the patent assigned to the Johns-Pratt Company, of Hartford, Conn.

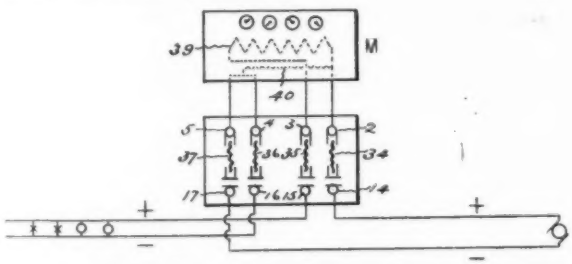


Fig. 2.—Fuse Block in Normal Service, Two-Wire System.

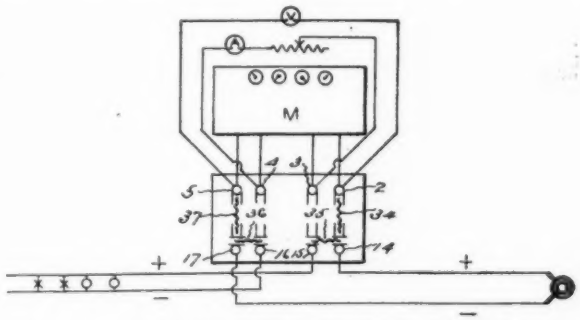


Fig. 3.—Fuse and Instrument Connections During Test.

LARGEST ELECTRICAL MINE HOIST IN AMERICA.

Electrically Operated Mine of the Christopher Coal Mining Company.

In the mine of the Christopher Coal Mining Company, recently organized at Christopher, Franklin County, Ill., will be installed the largest electric mine hoist in America. The mine is to be operated entirely by electric power and about half the capacity of the plant will be required for the hoist.

All the electrical apparatus has been designed in conformity with the latest practice, and the mine will undoubtedly be one of the most modernly equipped in this country. Power for the several operations will be generated at the mine by two 750-kilowatt, 3-phase, 60-cycle, 2,300-volt Curtis turbo-generators, for which excitation will be furnished by a 15-kilowatt, 125-volt turbo-exciter set.

Above ground practically all the machinery, except the hoist, will be operated by alternating current, while all the underground equipment is to be operated by 250 to 275-volt direct current, which will be supplied by three 300-kilowatt synchronous motor-generator sets, each composed of a 130-kilovolt-ampere, 2,300-volt synchronous motor, a 300-kilowatt, 275-volt compound direct-current generator and a 7.5-kilowatt, 125-volt direct-connected exciter. These units have extra capacity to furnish approximately 700 wattless kilovolt-amperes, and will be made use of when it is desired to raise the power-factor.

The hoist operates on the Ilgner system and is of the double-drum type, having seven-foot drums designed for an effective load of 9,000 pounds in a car and cage, the combined weight of which is 11,000 pounds. Wire hoisting rope 1.375-inch diameter is used. The equipment is being built to make 1,000 trips from a 600-foot depth in seven hours. The cycle planned calls for 6 seconds acceleration, 9 seconds at full speed, 6 loading and dumping, which corre-

sponds to a maximum rope speed of 2,400 feet per minute.

A 1,150-horsepower, 550-volt, direct-current motor drives the hoist and is direct-connected to the drum shaft by a flexible coupling. This motor is designed especially for hoisting service and has large overload capacity. Power will be supplied to the motor by a flywheel motor-generator set, consisting of a 650-horsepower 2,300-volt induction motor, an 880-kilowatt 550-volt generator, a 17-kilowatt, 125-volt exciter, and a 22,500-pound flywheel. This unit operates at 600 revolutions per minute. It is interesting to note that, through the Leonard method of control and the application of the flywheel, it has been possible to decrease the capacities of the hoist motor, generator and induction motor progressively contrary to usual practice.

The speed and direction of rotation of the hoist will be controlled by a controller at the operating platform, by means of which the voltage and polarity of the generator will be governed. The efficiency of this form of control, called the Leonard control after its inventor, H. Ward Leonard, is very high, as there are no rheostatic losses except the comparatively small ones in the field circuit of the generator. Fluctuations of the hoisting load are smoothed out by means of the flywheel and an automatic rheostat in the circuits of the induction motor.

The torque of the regulating motor varies with the line current and when this current tends to exceed a predetermined value, the torque of the regulating motor will overcome the weight of the moving parts of the rheostat, introducing resistance into the rotor circuits of the main induction motor, thereby causing the motor to slow down and allowing the flywheel to give up its energy. When the current tends to fall below the predetermined value, the weight of the moving parts of the rheostat will exceed the torque of the motor and the resistance will be cut out automatically. The weight of the moving parts of the rheostat is counterweighted for purposes of adjustment. In the control equipment are also included protective devices to guard against damage from overwinding, failure of alternating-current supply, loss of exciter voltage, loss of air pressure for the brakes, as well as extreme overloads. Both service and energy air brakes are provided.

No mules are to be used in this mine, and as the company also expects to eliminate them from its present Ziegler District colliery, 32 six-ton electric mine locomotives, having a rating of 3,000-pounds drawbar pull at six miles an hour, are included in the installation. A number of these locomotives are arranged for tandem operation, so that in case of breakdowns substitutions can be made. All tandem locomotives can be used either as six-ton gathering locomotives or 12-ton main line haulage locomotives.

A 250-horsepower variable-speed induction motor will drive the ventilating fan; and for operating the conveyors, shaker screens, picking tables, pumps, etc., several small induction motors ranging from 10 to 50 horsepower will be installed. The current for these motors and the air-compressor motor will be reduced by three 50-kilowatt transformers, 2,300 to 220 volts.

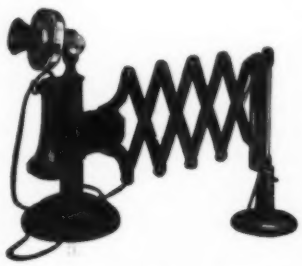
The equipment is completed by an 18-panel switchboard of dull black slate and 26 feet long for controlling all the electrical apparatus. The board will be fitted with all the necessary instruments, totalizing wattmeters being provided to record the total amount of energy delivered from the power station.

The hoist is to be of the Ottumwa Iron Works make, and all the electrical apparatus, including the mine locomotives, is being furnished by the General Electric Company.

A New Western Electric Transmitter Arm.

A recent development in the field of telephone apparatus and accessories is the Western Electric type No. 47 transmitter arm. This arm is of the folding or "ferry-gate" type and is furnished in three different styles so that it may be placed on top of a flat-top desk, on the wall, or at the side of a flat-top or roll-top desk.

The design is such that it may be



Swiveling Extension Arm.

used with any desk telephone by means of a clamping device at the end farthest from the pedestal. The use of the new transmitter arm is recommended for those telephone users who already have a desk set and find that they either habitually throw the set off the desk or else have trouble in keeping the cord and stand from becoming entangled with their papers.

Westinghouse Direct-Current Lightning Arresters.

The function of an ideal lightning arrester is to afford instantaneous and ample relief from dangerous abnormal stresses. As applied to electrical circuits lightning means much more than the commonly understood visible atmospheric discharges of electrical storms. It includes surges of current due to various causes and varying in

Fig. 1.—Station Arrester for Arc Circuits.

intensity with the power of the generating system; and also the many disturbances of balance due to induction, the static conditions consequent upon the drifting across the line of heavily charged clouds of rain, snow or fog and the simultaneous existence of varying conditions of temperature and weather upon one system.

So many and varied are the causes of these disturbances and the different conditions under which apparatus must

Fig. 2.—Line Arrester for Arc Circuits.

be protected that it is impossible to build a universal lightning arrester or one that will protect all apparatus on various kinds of circuits. It therefore becomes necessary to design arresters for different classes of service. The Westinghouse Electric & Manufacturing Company has placed on the market improved designs of types I and J lightning arresters for the protection of ap-

paratus on direct-current series arc lighting circuits having maximum voltages of 4,000.

The type I arrester (Fig. 1) is of the single-pole type. It consists of two metal electrodes mounted on and flush with the surface of a lignum-vitae block. A ready path for the lightning discharge is provided between the two electrodes by charred or carbonized grooves in the block. A second lignum-vitae block, fitted closely upon the first block, prevents the formation of gases or vapors, and eliminates all possibility of an arc following the discharge. This arrester is mounted on a marble base, for station use.

The type J arrester (Fig. 2) is similar to type I, but is inclosed in a weatherproof, galvanized-iron box, for line use, although it may be used either indoors or outdoors.

These arresters are designed for maximum effectiveness and are characteristic in structural excellence made possible only by the employment of the best materials and mechanical skill. Their reliability has been firmly established by the most thorough and exacting tests.

Grading of Suspension Insulators.

The suspension type of insulator, consisting of a series of insulating disks between line and ground, has made it possible to insulate lines for voltages of 100,000 to 300,000 with a sufficient margin of safety to make the undertaking a reliable engineering feat, and a safe commercial proposition.

The inventions of Louis Steinberger, Brooklyn, N. Y., relating to "Systems of Insulation for High-Tension Conductors, and High-Tension Insulators", provide means for keeping the line in operative condition even though direct lightning strokes should reach it. A patent was issued February 15, 1910 covering these insulators, which are shown in the accompanying illustration.

In an article entitled, "Some Problems of High-Tension Transmission," which appeared in the *Proceedings* of the American Institute of Electrical Engineers for March, 1912, Charles P. Steinmetz states:

"With a number of equal insulating disks sharing the voltage between line and ground, the potential difference across the insulators nearest the line is higher, and the potential difference across the insulators nearest the ground is lower, than the average potential difference per insulator, the more so the greater the number of insulator disks. * * * From this it appears that the use of a large number of small insulator disks is uneconomical at very high voltages, and a few large disks of high disruptive strength are preferable. * * * To extend the insulating possibilities of

Graded Suspension Insulator.

Graded Thimble-Type Suspension Insulator.

the suspension-insulator type far beyond the voltages now contemplated, therefore, requires a grading of the insulator disks in their capacity, so that the disk nearest the line has the highest, that nearest the ground the lowest capacity, or the addition of capacity at the surface of the insulator disks, in proportion to their distance from the ground."

This patent covers a number of new and very desirable features. In this patent, in place of disk-type insulators, "thimble-type" insulators are employed. The term "thimble type" was coined to denote the general thimble form of the insulator body, to distinguish them from disk or hood-type insulators.

Greenfielduct and the Evolution of Conduits.

One of the first interior conduit installations in the United States was made under the direction of E. T. Greenfield at Greenwich, Conn., in the spring of 1888. This, and a few other smaller installations made at that time, consisted of a zinc seamless tube purchased by Mr. Greenfield of Holmes, Booth & Hayden. This particular installation was a complete conduit system with outlet boxes at all outlets. The zinc seamless tube was terminated at and secured to a tin circular box at the light outlets, and to a wooden square box at the junction points. It was found impracticable to make use of seamless zinc tubing for the elbows, inasmuch as the tube would flatten at the bend, and accordingly, copper tubing was employed therefor.

The wires used in these conduits consisted of duplex conductor, substantially the same as the flexible cord of today, except that the insulation consisted of a very thin layer of rubber.

The practice, even at that early date, of grouping a small number of lamps on a branch circuit and protecting the individual circuits with fuses at the common distribution center, was recognized as desirable.

Prior to 1889 interior electrical wiring was installed almost entirely in accordance with the ideas of the superintendent or foreman of each installation; and although many competent men were thus engaged, their methods were largely those suggested by the practice of the times, and occasional conditions which might require a special construction. Usually the conductors were secured to the walls and ceilings by cleats or moldings and in many cases they were simply buried in plaster without any distinctive method of securance.

E. T. Greenfield and E. H. Johnson early recognized the necessity of providing an insulating conduit for electrical conductors and on March 11, 1889, these gentlemen organized the Interior Electrical Conduit Company,

Incorporated, for the purpose of manufacturing a paper-insulated tube under the patents which had been issued to them; and their first factory was located at 154-156 West Twenty-seventh Street, New York City. This company manufactured, under the Greenfield and Johnson patents, a complete system for interior wiring, and in so doing established an industry that now forms the basis of almost every large equipment for interior wiring. This unarmored conduit was sometimes referred to as asphaltic paper tube and represented the result of the company's first effort. It was the only conduit used for interior wiring until 1891 when, for the purpose of increasing the mechanical protection afforded by the conduit to the conductors, the Interior Conduit & Insulation Company, a reorganization of the Interior Electrical Conduit Company, introduced its brass-armored conduit.

This conduit was simply an asphaltic paper tube over which was folded longitudinally a covering of thin sheet brass. During the time when asphaltic paper with rubber covering was manufactured, a large line of circular asphaltic paper boxes for outlet and junction purposes was available and largely used.

When the asphaltic paper tube was treated with the brass sheath, the outlet boxes were likewise sheathed with a thin brass covering. These asphaltic paper outlet boxes were provided with knock outs and the journeymen electricians found little difficulty in making a first-class conduit job with this paper conduit, inasmuch as these paper knock-out boxes could be employed for various classes of outlets, just as steel knock-out boxes of today.

Brass-armored conduit, together with the unarmored asphaltic paper-tube conduit held the market without competition until the year 1894, when the company placed upon the market its iron-armored insulating conduit, composed of selected gas pipe lined with asphaltic paper tubing.

When the insurance interests approved of the use of an unlined rigid pipe as a race-way for electrical conductors in 1897, it was foreseen by this company that many of the users would not pay for the high cost of such a conduit, while at the same time Mr. Johnson would not consent to meet the competition of an unlined pipe having a mere treatment of thin black enamel that was sure to break or flake off readily and especially at the bend.

In 1897 the Interior Conduit & Insulation Company was reorganized under the name of Sprague Electric Company, at which time Frank J. Sprague became associated with Messrs. Johnson and Greenfield.

The Sprague Electric Company continued for two years to market iron-armored insulating conduit with a complete line of iron-armored outlet and junction boxes, but in 1899 it introduced the Greenfield flexible steel conduit and the Greenfield flexible steel-armored conductors, the armor of which was treated with a molten zinc, rendering it proof against rust.

The Sprague Electric Works of General Electric Company is introducing a form of unlined rigid conduit that required the ingenuity of Mr. Greenfield to perfect. He has developed a hot galvanizing and wiping process which produces a perfectly smooth and uniform coating of zinc on the interior and exterior of the conduit pipe and it is this product of Mr. Greenfield's, known as Greenfielduct, that the Sprague Electric Works is now presenting to the trade.

Belcher Patented Ground-Wire Clamp.

A patent on a wire clamp, specially designed for the purpose of attaching transmission-line ground wires to bayonet angles or steel towers, was

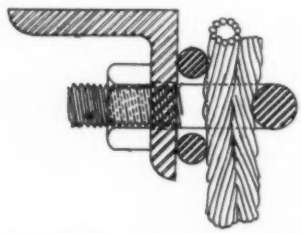


Fig. 1.—Sectional View of Belcher Clamp.

recently granted to Wallace E. Belcher, 175 West Jackson boulevard, Chicago, Ill. As shown in the accompanying diagrams, the clamp consists of a J-

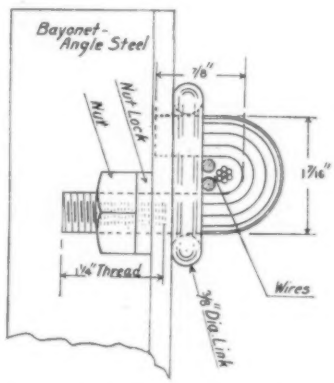


Fig. 2.—Elevation of Belcher Clamp.

shaped bolt with the extended arm threaded, an elliptical link of round section, such as used for chains, and a nut and nut lock. The clamp presents only rounded surfaces to the wire ropes or cable. The strand is not only gripped on all sides by round surfaces, but is at the same time held away from the steel angle or tower to avoid any possible fraying or other injury to it from sharp corners or edges. Moreover, the clamp can be put through the holes in the steel support without removing the clamping nut from the bolt. It is therefore very quickly installed and the danger of losing nuts is avoided.

In some cases a U-shaped bolt with two long threaded legs of equal length is used, especially for connecting or splicing two or more cables or ropes. In any case when the bolt is drawn up by screwing the nut or nuts, the cables are drawn into the slot in the link, as shown in Fig. 1, thus giving a firm grip. Fig. 2 shows the outlines and dimensions of one size of the Belcher clamp as manufactured by Hubbard & Company, Pittsburgh, Pa.

New Nelite Enameled-Steel Dome Reflectors.

The Nelite "Dome" is the latest metal reflector of the Nelite Works of General Electric Company. As the illustration shows, it is a very shallow type of porcelain-enameled steel reflector, designed for service where the so-called flat types have heretofore been employed. Its scientific design, however, gives the dome type several advantages, chief of which are the minimum glare effect and the desirable distribution of light, both of which are secured at no sacrifice of efficiency.

The dome-type Holophane-D'Olier reflectors are particularly adapted to

Dome Reflector.

service in rooms with low ceilings or where the total area to be lighted is large in comparison with the distance between units.

The Nelite Works has greatly improved the manufacturing facilities and methods of its steel-reflector department, since taking over the Holophane business. Heavier steel is now used in the construction of all the smaller sizes of metal reflectors; a method of galvanizing has been perfected whereby the bodies of aluminized reflectors are rendered impervious to moisture and fumes, and an oxi-acetylene process of welding the holders to the reflector bodies is now employed which makes the finished units as solid as a single piece.

These developments have been carried on under the direction of Henry D'olier, Jr., who promises further improvements in the Nelite lines of metal reflectors within the next few months.

Electrical Equipment of the New York Tribune.

The *New York Tribune* has just installed in its new plant a very complete and up-to-date electrical equipment.

Two new presses are each driven by a 60-horsepower double-motor, full automatic control system, with complete push-button operation and all the latest automatic adjustments and safety devices. These motors have a field variation of 2 to 1, so that economical control is secured to the entire range of driving speeds. The presses are of the tandem sextuple type built by the Duplex Printing Company, Battle Creek, Mich., and have a maximum capacity of 30,000 24-page papers per hour.

Each press is started and run at slow speed by a 10-horsepower motor, which is connected to a large motor through reduction gearing and an automatic clutch. The control of the motors is through push-button stations, eight of which are located at convenient points about each press.

The controllers are of the latest Sprague full automatic type and incorporate the following automatic and speed devices: No-voltage release, overload release, push-button speed control, push-button "jog," push-button "stop" and independent push-button circuit for emergency operation.

Each panel contains a recording wattmeter, so that the daily power requirements of the individual presses can be carefully watched.

Sprague Electric motors are used to drive the stereotyping machinery, including tail cutters, shavers, motor-operated steam tables and the linotype machines. There are over 30 linotype machines individually driven by Sprague motors.

A Sprague Electric hoist running on twin I-beams has been installed over each press for handling the paper rolls. These hoists are specially designed for this installation and can be adjusted to handle rolls of varying widths.

To handle the extra power required to operate this machinery, a Sprague Electric 200-kilowatt, 125-volt, direct-current generator has been installed, direct coupled to an American Ball, 260-revolutions-per-minute angle compound engine.

The switchboard has been remodeled with new instruments, switches, etc., and Sprague conduit has been used in wiring the installation.

Fleet of Electric Roadsters for Trouble Work.

The automobile trade has been accustomed for some time to large orders for commercial cars. The Waverley Company, of Indianapolis, Ind., has recently filled an order from the Louisville Lighting Company, of Louisville, Ky., for six Waverley electric roadsters for the use of its trouble and repair departments. These are in addition to four light delivery wagons of the same make.

Fleet of Electric Roadsters for Louisville Lighting Company.

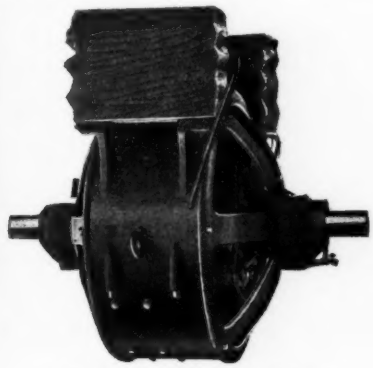
As will be seen by the accompanying photograph, a box has been added to the rear of the roadsters to accommodate the tools and supplies for quick repair work, while a larger supply of material will be carried in the light delivery wagons.

This roadster is of the same model as that which covered 1,400 miles in twelve days in the "Four State Tour" with Indiana cars last year. This showed its capacity for receiving hard knocks and keeping in service under all varieties of weather and road conditions.

The picture represents these roadsters drawn up before the Waverley office and factory ready for shipment. The light delivery wagons will be forwarded in a later shipment.

Motor for Ceiling Suspension.

Herewith is illustrated a motor suitable for ceiling suspension and direct coupling to line shafts. The motor is of the commutating-pole type with bearings carried in rigid six-arm bonnets and the frame divided horizontally, there being eye-bolts on each side with tap holes in both parts of the frame, so that the entire motor may be conveniently lifted in place and, if necessary, the lower part can readily be removed. Particular attention has been paid in the design to giving an extra-heavy shaft with very liberal bearing surface, yet by the use of a steel frame and by taking the fullest advantage of the commutating-pole feature an extremely light and compact design has been obtained. The 50-horsepower, 200-revolutions-per-minute motor here shown has a net weight of approximately 7,000 pounds, and therefore requires far less special construction in connection with the roof truss from which it is supported than would be the case with the ordinary slow-speed motor, the weight of which would be in excess of 10,000 pounds. This motor has been developed by the Diehl Manufacturing Company, Elizabethport, N. J.



Ceiling-Suspended Diehl Motor.

Motors for Industrial Plants.

The new plant which the H. W. Johns-Manville Company, well-known manufacturers of asbestos materials, is now building at Bound Brook, N. J., is to be operated entirely by electric power. The installation in the power station will comprise one 1,000-kilowatt and one 1,500-kilowatt Curtis turbo-generators, for which excitation will be furnished by a 35-kilowatt turbo-exciter and a 35-kilowatt motor-generator set. The apparatus is being furnished and installed by the General Electric Company.

The Fuller-Warren Company, Milwaukee, Wis., is arranging for equipping its stove works with electrical drive and will install 61 motors, rang-

ing in capacity from 1.5 to 50 horsepower. These motors are all of the General Electric Company manufacture.

The Semet Solvay Company, Syracuse, N. Y., will install in its plant at Solvay, Ill., a 1,875-kilowatt Curtis turbogenerator, which has been ordered from the General Electric Company.

General Vehicle Company Acquires Mercedes Gasoline Truck.

In response to numerous requests from purchasers and the trade throughout the country, President P. D. Wagoner of the General Vehicle Company has issued through the publicity department at Long Island City, N. Y., the following statement regarding his company's acquisition of the American rights of the Mercedes gasoline truck manufactured by the Daimler Motoren Gesellschaft of Germany:

"As the largest builders of electric commercial vehicles in the world, the General Vehicle Company has had an opportunity in its 12 years' experience of studying deeply, not only problems of truck manufacturing and vending, but of service adaptability as well. The wide distribution of its product has shown that well built electric trucks can care for from 80 per cent to 85 per cent of all average urban trucking and delivery. That is, in relatively short-haul work, especially where stops are necessary, the electric is the most economical as well as the most dependable commercial vehicle. For longer haul, cross-country work, where higher speed and greater radius of action are essential, the gasoline truck is unquestionably superior. The General Vehicle Company, while recognizing this situation in the past, held strictly to the electric field, and where the service conditions warranted it, cheerfully recommended gasoline trucks to its own customers.

"Financial strength and the ability to supply a complete commercial vehicle equipment for any line of business have now become two of the requisites necessary to the successful manufacture of motor trucks. We have ample capital and the development of the art has reached a point where it has seemed wise for the General Vehicle Company to be in a position to supply purchasers requiring long and short-haul service with their entire motor truck equipment, particularly as many of them after using our trucks for years have made this suggestion. Many of our customers seemed disposed to realize the advantage to them of dealing with one large, strong manufacturer rather than with several.

"In studying the problem, investigation revealed the fact that a large number of American made, long-distance trucks seem to have been designed for city rather than cross-country service. Instead of being constructed for years of hard work under variable conditions, they seemed designed more to compete in the sphere of the electric, which is not, and can not be, the sphere of the gasoline machine.

"After thoroughly analyzing the situation in America, I turned to Europe in our search for the ideal, spending three months in continuously studying European conditions and designs, accompanied by our factory manager and our engineer. We investigated all motor trucks of European manufacture, and interviewed hundreds of users. Our investigation developed the fact that while there were good trucks in England, France and Germany, giving good results under their conditions of road operation, there was only one truck which was unquestionably fitted

P. D. Wagoner,
President, General Vehicle Company.

for service under American conditions, namely, the Mercedes. We were surprised to find that not only was this truck giving excellent results over a long period of years where road conditions were favorable for heavy haulage, but in certain mountainous and rural districts where we found road conditions fully as unfavorable as we have here, this truck was giving from 6 to 10 and even 12 years' exceptional service. Its record in cross-country work compared very favorably with shorter hauls on perfect roads.

"After considerable difficulty we succeeded in securing the right to import German manufactured Mercedes commercial vehicles and the exclusive manufacturing rights for the same in the United States."

Pending the completion of manufacturing arrangements the General Vehicle Company will import Mercedes trucks to supply the immediate demands.

Remote-Recording Electric Car Register.

There has been placed on the market by the Automatic Register Company, of East St. Louis, Mo., an electric street-car register designed to prevent any attempt at fraud. The device automatically registers in the auditor's office of the railway company, in the same way as it does on the cars, the amount of cash placed in the box by the patrons. The conductor's receiving box is electrically connected through a trolley wire with a recording device in the auditor's office, so that should the conductor in making his daily report, make a miscalculation, an investigation of the device would reveal it. The line is divided into zones and when a car is recording the fares, it is impossible for another car to record. The car may be running at full speed through the zone, but the fares will be recorded just the same, only five seconds being required in recording the number of fares. A combination of cog wheels and several induction coils, called an impulse gatherer and transmitter, indicate the number of fares collected on the moving car in the office of the auditor. This device is being installed on the East St. Louis & Suburban Railway.

The Automatic Register Company is capitalized at $1,000,000. Its officers are: President, Adolphus D. Branham; vice-presidents, W. P. Launtz, J. M. Dill, Ernest Lane, Adolph R. Korreck; secretary, John R. Williams; treasurer, Paul W. Abt; electrical expert, James H. Duncan; mechanical expert, Wm. H. Drake; superintendent, Jos. W. Beeson.

Meeting of British Lamp Salesmen.

At Rugby, England, on July 8 and 9, the British Thomson-Houston Company's lamp salesmen from all parts of Great Britain held their annual meeting. Forty active representatives, full of enthusiasm for their work, took part in the proceedings, which included papers and discussions, as well as the all-important convivial element. A feature of the latter was the introduction of a new song, "Everybody's Buying Them!" to the tune of "Everybody's Doing It"—"them" being, of course, Mazda lamps.

Fostoria Lamp Sales Conference.

The annual summer conference of the salesmen of Fostoria incandescent lamps was held July 14 to 20 at Ballast Island, O., under the general direction of H. H. Geary. Forty-two men were in attendance, and the meetings were very successful from every standpoint. Among the speakers were Paul Bauder and N. H. Boynton, who explained the extensive publicity campaign which is to be conducted soon for the stimulation of sales of "National Quality" Mazda lamps.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MITCHELL, S. D.—The Council has voted to install 46 cluster lights.

MILLER, S. D.—Bonds for $6,000 were voted for a municipal lighting plant. C.

LUVERNE, MINN.—Bonds for improving the electric light system were voted. C.

FARIBAULT, MINN.—The council ordered curb lights along First Avenue and cross streets. C.

LEHIGH, IOWA.—Bonds for $20,000 have been voted for an electric light and water plant. C.

IOWA CITY, IOWA.—The Commercial Club is agitating for electroliers in the business district. C.

ANOKA, MINN.—It is projected to extend a power line to Elk River to furnish light and power. C.

EAST GRAND FORKS, MINN.—Bids will soon be taken for the proposed electric light plant. C.

RED LODGE, MONT.—Property owners in the business district have petitioned for five blocks of cluster lights.

TRINITY, TEX.—The City Council has granted a franchise to H. H. Thompson to install an electric light plant.

PERRY, IOWA.—The new owners of the Perry Electric Light, Heating & Power Company will rebuild the plant. C.

SLATER, IOWA.—A 25-year franchise has been granted to the Boone Electric Light Company for electric lights. C.

HASTINGS, NEB.—A movement has been inaugurated to install an ornamental lighting system on First Street.

HIBBING, MINN.—The Water and Light Commission have been petitioned to install a white-way ornamental lighting system. C.

DESHLER, NEB.—The Deshler Light & Power Company has purchased a site for the erection of its powerhouse.

MARSHALL, MINN.—F. S. Cook and W. C. Haney are busy interesting the business men in establishing cluster-curb lights. C.

HUNTINGTON, ARK.—The Electric Light & Power Company is preparing to extend a 2,300-volt power circuit to Mansfield.

STOCKTON, CAL.—The City Council has passed an ordinance requiring all electric wires to be placed underground before June 1, 1913.

WATERTOWN, MINN.—H. B. Rutledge of Glencoe (Minn.) Light & Power Company, has been granted an electric light franchise. C.

TAYLORSVILLE, KY. — Henry Brothers have a franchise for the operation of an electric light plant, and will purchase equipment immediately.

JACKSON, GA.—The Mayor has in charge the matter of extending the electric light system and a bond issue of $6,000 has been voted for the purpose.

HOT SPRINGS, ARK.—Hot Springs Electric Company will reconstruct its power plant under the supervision of the National Light & Power Company, St. Louis, Mo.

BURKESVILLE, KY.—The Burkesville Light & Milling Company has been incorporated with a capital stock of $1,800 by C. C. Baker, C. R. Payne and J. H. Baker.

GLADWIN, MICH.—The Gladwin Light & Power Company has been incorporated with a capital stock of $50,000. The new company will engage in a light and power business.

SCOTLAND NECK, N. C.—The Town Commissioners have decided to install a larger dynamo at the power plant and substitute tungsten lamps in place of the arcs now in use.

STEARNS, KY.—The Stearns Coal Company is considering furnishing power for the operation of a traction line which it is proposed shall be built from Stearns to Whitley City. G.

SPOKANE, WASH.—Belgo-American Corporation has been incorporated with a capital stock of $600,000 for the purpose of engaging in the business of electric and steam power plants.

COLERAIN, MINN.—The installation of a lighting system has been postponed, all bids received on June 15 having been refused. W. W. Hunter, village clerk, has the matter in charge.

EDEN VALLEY, MINN.—An electric light franchise was granted to the Lethert Electric Company, of St. Paul. A power plant will be erected here large enough to supply the surrounding villages. C.

FORT MADISON, IOWA.—The Mississippi River Water Power Company has under way a project to erect and maintain poles and wires for the transmission of electric energy to Fort Madison.

MOUNTAIN CITY, TENN.—Roan Creek Electric Light & Power Company has been incorporated with a capital stock of $5,000. W. W. Worley, Shouns, Tenn., is at the head of the company.

KENDALLVILLE, IND.—Members of the Town Board of Avilla have been conferring with the Kendallville councilmen with regard to purchasing electric power to light the streets and residences of Avilla.

BROWNWOOD, TEX.—The Texas Light & Power Company has taken possession of the property of the Brownwood Gas & Electric Company, and it is understood that important improvements will be made.

SPRINGFIELD, MASS. — Messrs. Orrin Hicks, Merritt Dunham and Edward B. Brown compose a committee which has in charge the matter of electric lighting for the streets of the Center Village and East Brimfield.

POTEAU, OKLA.—A charter has been granted to the LeFlore County Gas & Electric Company, having a capitalization of $250,000. The incorporators are Grey Moore, J. T. Little and T. R. Lunsford, all of Poteau.

TOPEKA, KANS.—It has been estimated that it will cost the city $9,500 to add new machinery to the light plant but this is considered no objection by Commissioner Miller, who is one of those having the matter in charge.

MACON, GA. — City Electrician Humphreys and the officials of the Macon Railway & Light Company have under consideration a plan which may lead to the white-way system of lighting being extended over the entire city.

PROVIDENCE, R. I.—The New Haven Railroad has announced that it will build a big powerhouse at this place, which it is expected will be used to operate both the road to Boston and the street cars of this city and vicinity.

BURKESVILLE, KY.—The Burkesville Light & Milling Company, which recently contracted for the installation of a street lighting system, has been incorporated with $1,800 capital stock. The incorporators are C. C. Baker, C. R. Payne and others. G.

PENN YAN, N. Y.—The Yates Electric Light & Power Company has under consideration a pole-transmission line along the route of the New York Central to Seneca Mills, which plant the company will supply with light and power.

DALLAS, TEX.—The Chamber of Commerce has made the announcement that decorative lighting for parts of Commerce, Main and Houston streets is now an assured fact and that the city will soon be in a position to let the contract.

HAVERHILL, MASS. — Only a small portion of the $10,000 which is being raised by popular subscription by the Haverhill Advertising Club and the Haverhill Board of Trade for a new system of street lighting remains to be subscribed.

LITTLE ROCK, ARK.—Articles of incorporation have been filed by the Brinkley Water & Light Company, which is capitalized at $50,000. The incorporators are J. E. Thompson, W. W. Sharp, Elmo Charey, J. W. Neff and J. S. Mitchell.

BRADFORD, O.—The Pennsylvania Railroad is preparing plans for the installation of a $40,000 electric power house at this place, which will be used to light the extensive yards of the railroad and provide power for the operation of the machinery.

PORTLAND, ORE.—Reed College will erect a power house at a cost of $15,000, which will furnish light and

power for all the college buildings, and also be a training school for students. Architects Doyle, Patterson & Beach are preparing the plans.

WINCHESTER, KY.—George Tomlinson will install an electric power plant for the operation of a large wood-working plant which will be used for the manufacture of tobacco hogsheads. The wood-working machines will be individually motor-driven. G.

SAN FRANCISCO, CAL.—The Pacific States Electric Company is preparing to build a six-story building which will be equipped with two elevators and two high-speed electric hoists. The building is to be completed by the middle of November.

EATONTON, GA.—The City Council has appointed a committee consisting of W. S. Smith, R. K. Matthews and J. M. Rainy to consider installing an electric plant for general lighting of streets and buildings, and it is reported that bids will soon be asked.

ANGELITA, TEX.—O. L. Hubbard, of Chicago, who reecntly purchased a tract of 2,000 acres of land near here, is preparing to establish a town upon the property. He will install an electric light plant, waterworks system and other modern improvements. D.

DALLAS, TEX.—Texas Utilities Corporation has been incorporated with a capital stock of $240,000 for the purpose of manufacturing and supplying electricity to about 50 counties. The incorporators are J. D. Oliver, Charles E. Hubbell and George H. White.

SPRINGFIELD, ILL.—Francis J. Peabody is said to be back of extensive purchases of coal rights in Christian and adjoining counties, which is taken to foreshadow a gigantic electrical power enterprise which will include transmission wires over a radius of 100 miles.

BIRMINGHAM, ALA.—The Alabama Interstate Power Company, of which W. W. Freeman of the Edison Illuminating Company of Brooklyn, N. Y., is an officer, plans to expand its field and wholesale electric current to existing corporations in Alabama cities and towns.

TONO, WASH.—The Washington Union Coal Company has made an appropriation of $280,000 for improvements at Tono, which is strictly a company town located a few miles northeast of Centralia. These improvements will include a new power plant and water system.

ELMIRA, N. Y.—The Public Service Commission has granted permission to the Elmira Water, Light & Railroad Company to issue bonds to the extent of $201,000, the proceeds of which are to be used for various improvements, including extension of the water and electrical developments.

DELPHOS, O.—The owners of the Delphos and Van Wert electric light plants are planning to extend their lines over a vast amount of territory, which will enable them to give electric light service to Middle Point, Ohio City, Fort Jennings, Ottoville and farmers residing along the route.

BIRMINGHAM, ALA.—The Alabama Fuel & Iron Company has made an appropriation of $80,000 for the construction of a central electric plant to distribute power to its four plants at Acmar, Margaret, Acton and a new opening. It is stated that a transmission line eight miles in length will be built.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company is interested in the campaign to have French Street one of the best lighted streets in the city, and it is understood that some of the business men of French Street are considering the installation of ornamental lighting standards.

SEDALIA, MO.—A new light and traction company has been organized at this place with C. E. Murray, R. A. McGregor and J. E. Harsh, of Joplin, as stockholders. The capital stock of the company is $1,500,000 and the object is the development of natural gas, the manufacture of gas and the development of electricity for supplying Sedalia.

GREENCASTLE, IND.—S. C. Sayres, city clerk, will receive sealed bids until August 27 for lighting the city for a period of 10 years, beginning July 1, 1913. This contract will include a 20-year franchise to supply electricity for lamps and motors. Specifications, etc., may be obtained from the consulting engineers, McMeans & Tripp, Indianapolis, Ind.

MUSKOGEE, OKLA.—The Muskogee Water Power Company is to be incorporated under the laws of Oklahoma with a capital stock of $10,000. A committee composed of S. P. Mann, J. F. Darby, A. C. Trumbo, H. H. Ogden and D. N. Fink has been appointed to confer with Sam Brown, Jr., of Chicago, in regard to financing the hydro-electric project which the company has under way.

MORRISTOWN, TENN.—The Morristown Power & Development Company, of which John Loop is president, and the Morristown Interurban Railroad Company, of which W. H. Mullens is president, have filed articles of incorporation and the officers have been instructed to secure franchises for both power and railroad, and push the work to completion as fast as possible. These companies propose to harness the waters of the Nolachucky and Clinch Rivers and supply power to upper Eastern Tennessee for lighting, manufacturing and railway purposes.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BOISE, IDAHO.—Bids will soon be called for installing an underground cable system.

CUCAMONGA, CAL.—The Ontario & Uplands Telephone Company plans to establish an exchange here.

GRINNELL, IOWA.—The Interior Telephone Company will modernize its plant in all departments, at an estimated cost of $25,000. C.

DURHAM, N. C.—The Interstate Telephone & Telegraph Company is planning to install an underground system.

WILCOX, ARIZ.—The New State Telephone & Telegraph Company has been incorporated by D. A. Adams, T. J. Riggs and H. A. Morgan.

PINEWOOD, S. C.—Pinewood Telephone Exchange has been incorporated by Walter D. Epperson, J. W. Weeks, R. C. Richardson and O. D. Harolin.

SACO, ME.—The New England Telephone & Telegraph Company has been granted permission to lay its wires underground in certain streets of this city.

OLYMPIA, WASH.—The Nile Telephone Company has been incorporated with a capital stock of $2,400 by A. R. Abel, G. W. Johnson and James A. Beck.

ARKADELPHIA, ARK.—The City Council has under advisement a franchise ordinance to be granted to local capitalists for an independent telephone system at this place.

TROPICO, CAL.—Bids will be received up to September 5 for a franchise granting the right to construct a telephone and telegraph system along the streets of the town.

FULLERTON, CAL.—Bids will be received up to September 2 for a franchise granting right to transmit electricity for telephone and telegraph purposes along streets of the town.

DOUGLAS, ARIZ.—W. C. Corey is preparing to install an independent telephone exchange and system here. He has signed up about 300 subscribers for the proposed new service. D.

OAKESDALE, WASH.—H. Higgs, of Rosalia, has purchased the Oakesdale telephone exchange and will establish connections with all the city and country lines in Oakesdale and vicinity.

DUNKIRK, O.—The Dunkirk Mutual Telephone Company has been incorporated by Paul F. Dornbirer, F. F. McCloud, R. E. Clevenger, H. D. Jones, William McEltree and W. H. Getz.

GOLDTHWAITE, TEX. — The Brown Telephone Company has extended its long-distance system to Brownwood and also contemplates installing a local exchange at that place.

ANDERSON, S. C.—Southern Bell Telephone & Telegraph Company will lay about 15 miles of new cable and make other improvements to its system, which will cause an expenditure of about $300,000.

CHASELEY, N. D.—The Chaseley Co-operative Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are N. E. Kellems and G. F. Church, Chaseley; G. D. Harrington, Bowdon.

BAY CITY, MICH.—The Valley Home Telephone Company has been granted authority to issue $17,000,000 worth of bonds, the proceeds of which will be used for making improvements and extensions to its system.

OROVILLE, CAL.—Plans have been completed for placing all the telephone wires underground in the business section of the city, and it is expected that this will eventually result in the rest of the wires going underground.

WEST HOPE, O.—The West Hope Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are Fred Springhorn, Louis Laing, George Sidell, Daniel Thurston and Ed. Frankfather.

CASS, W. VA.—Cloverlick & Durbin Mutual Telephone Company has been incorporated with a capital stock of $1,500. The incorporators are C. C. Wanless, H. L. Kessler, Allen Galford, Wanless; W. R. Moore, Stony Bottom, and Max Curry, Cass.

HUGHSON, CAL.—The Hughson Telephone Company has filed articles of incorporation, the capital stock being $5,000. F. C. Nickle, Ella S. Nickle and Della C. Lutz are the directors of the company. A telephone line not over 50 miles in length will be constructed and operated by the new company.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CLEVELAND, O.—The St. Clair car line will be extended to Nottingham.

HENDERSON, KY.—The Tennis Company is considering a plan to construct an interurban railway between Henderson and Owensboro. G.

ALBANY, N. Y.—Cornelius F. Burns of the United Traction Company has purchased the franchise for a street railway in the section known as the "New Village."

ROME, N. Y.—The Public Service Commission has been petitioned to grant a certificate of necessity and convenience to the promoters of the Rome & Oneida Railway Company for the proposed road between Rome and Oneida.

CHICAGO, ILL.—The Central Illinois Public Service Company has purchased the Tuscola (Ill.) Light & Water Works plant and is arranging to take over a score or more of plants and will, it is rumored, build an interurban railway.

TUSCALOOSA, ALA.—The Light Company has submitted a proposition to the City Commissioners relative to the extension of the lighting contract, wherein the company will build and operate an electric car line into Tuscaloosa from Holt and Kaul.

SAN FRANCISCO, CAL.—Major-General Arthur Murray has approved and forwarded to Washington plans for a trolley line from the end of the present Union Street line at the Presidio through the reservation to Fort Winfield Scott, a distance of three miles.

LUDLOW, VT.—A new public utility company, called the Western Vermont Light & Power Company, has filed articles of incorporation with a capital stock of $2,300,000, for the purpose of extending the trolley lines and power plants of the Rutland Light & Power Company.

SHERMAN, TEX.—The Texas Traction Company is preparing to extend its Dallas-Sherman line to Oklahoma City, Okla., and contracts will soon be let. One of the most important features of the line will be the construction of a bridge across the Red River, north of Denison.

MOORHEAD, MINN.—Executive committees from the Moorehead and Fargo Commercial Clubs have pledged rights of way to the Moorehead & Fargo Street Railway Company for a five-mile extension of the line from Moorehead to Dilworth. It is said that construction will be started at once.

WASHINGTON, MD.—Congressman Parran of Maryland has recently set on foot a movement for the Government to build a single-track electric line from Washington to Indian Head. The project calls for an appropriation of $10,000, and as the line is much needed it is probable that it will be constructed.

MEMPHIS, TENN.—Arrangements are being made for the completion of the receivership of the Lakeview Traction Company and the reorganization of the road. St. Louis capital is to finance the construction of its lines from Memphis to Lakeview and Collerville, Tenn. G.

NEW YORK, N. Y.—A syndicate of capitalists, headed by Thomas P. McKenna of this city, has purchased the rights of the New York & North Jersey Rapid Transit Company in Paterson, and it is reported that work will soon be started on an electric line from Paterson to New York, which will cost about $18,000,000. The proposed line is to run overhead and underground.

NEW YORK, N. Y.—It has been announced that contracts for electrical equipment for the new subways, which represent an expenditure of nearly $15,000,000, will be let in September. The Public Service Commission will not decide upon the style or quality of electrification other than that the motive power must be up to a certain standard, the operating companies themselves making this decision.

NEW HARTFORD, N. Y.—The Sauquoit Valley Electric Railway Company is being formed for the purpose of building an interurban from New Hartford to Clayville. It has been announced that no opposition to the project will be offered by the Public Service Commission and that construction work will soon be started. H. C. Bentley Company, of New York, is promoting the road.

INDIANAPOLIS, IND.—The Crawfordsville & Danville Traction Company has filed articles of incorporation with the Secretary of State. The initial capital is $10,000. The object is to build and operate street and interurban railroads in the towns and cities connecting the city of Crawfordsville and Danville, Ill. The directors of the new concern are John A. Shafer, M. B. Keller, J. F. Edwards, Indianapolis; O. P. C. Green and C. B. Marshall, Kingman.

HAGERMAN, IDAHO.—The building of two electric railways into Hagerman Valley is the likely outcome of the present conditions. Both the Kuhn and Nunn interests have been planning roads. L. L. Nunn is president of the Telluride & Beaver River Power Company. A road was graded into the Hagerman Valley with money put up by the farmers of this region, but it is rumored that the Kuhns intend to abandon this route and build a road through Wendell.

BEAUMONT, TEX.—The City Council has granted the Beaumont Light & Power Company, a 25-year extension to its lighting franchise with the understanding that Stone & Webster commence actual work on the interurban between this city and Port Arthur within nine months and have the line completed and in operation by December 31, 1914. Surveys have been made and it is announced that as soon as the route is selected rights of way will be procured and construction work started.

SAN FRANCISCO, CAL.—Application has been filed with the Railroad commission by the Anglo-California Trust Company and the United Railroads for the authorization of the purchase of 65 street cars at a price not to exceed $365,000 or a little less than $6,000 a car. The Trust Company will act as the trustee. The cars will be purchased direct from the manufacturer and held by the Trust Company. They will be paid for as needed by the United Railroads.

DALLAS, TEX.—It is reported here that the Stone & Webster Engineering Corporation of Boston, Mass., is having plans prepared for an interurban electric railway union station and terminal facilities here that will cost about $1,500,000. The activity of this company in constructing an extensive system of electric railways out of Dallas makes it necessary, it is said, for it to provide a large passenger and freight station and yard trackage. D.

NEW INCORPORATIONS.

Burlington, Ia.—The Home Electric Company has been incorporated with a capital stock of $10,000. C.

SULTAN, WASH.—Sultan Electric Company has been incorporated with a capital stock of $15,000 by Frank I. Anderson and Frank Friese.

ABERDEEN, S. D.—The Automatic Telephone Company has been incorporated by T. L. Zietlow and others to manufacture an automatic device.

CHICAGO, ILL.—Nostrum Electric Company has been incorporated with a capital stock of $50,000 for the purpose of engaging in the manufacturing business. Nils E. Nostrum, J. Arthur Johnson and Marie Hahn are the incorporators.

BROOKLYN, N. Y.—Monarch Direct Current Electric Transformer Company has been incorporated with a capital stock of $100,000. The incorporators are Richard J. Ward, Richmond Hill; Alix A. Lambert and Frederick C. Lambert, Brooklyn.

CLEVELAND, O.—The Just Tungsten Lamp Company has been incorporated with a capital stock of $10,000 for the purpose of dealing in electrical supplies. The incorporators are R. B. Richardson, A. H. Otis, M. J. O'Donnell, A. G. Newcomb and M. L. Tennie.

CHICAGO, ILL.—Swedish-American Telephone Manufacturing Company has been incorporated with a capital stock of $60,000 for the purpose of manufacturing electrical apparatus. The incorporators are Donald L. Morrill, Gertrude Holz and William H. Johnson.

CHICAGO, ILL.—Consumers Mutual Light Company has been incorporated with a capital stock of $35,000 for the purpose of manufacturing and installing gas and electric lights and fixtures. The incorporators are Edwin P. Richter, Charles D. Wright and J. H. Maertin.

CHICAGO, ILL.—Independent Pole & Crossarm Company has been incorporated with a capital stock of $10,000 for the purpose of manufacturing poles, crossarms and other materials used in constructing telephone and telegraph lines. M. F. Schmidt, D. Kimball and Joseph Green are the incorporators.

RUTLAND, VA.—The Western Vermont Power & Light Company has filed articles of incorporation with a capital of $2,300,000. Its purpose is extend the trolley system in Rutland. The incorporators are A. L. Norman, of New York, and Thomas W. Maloney, W. H. Lawson, Myrick L. Arthur, Albert S. Reed and Charles H. West, of this city.

EAST ST. LOUIS, ILL.—The Automatic Register Company has been incorporated with a capital stock of $1,000,000 with Adolphus D. Branham as president and general manager. The company has the sole right of manufacturing a device for automatically registering in the auditor's office of an electric railway company the amount of fares placed in the receiving cash boxes on the cars. C.

FINANCIAL NOTES.

So far as security values may indicate the present industrial and economic outlook, there appears to be a latent fear upon the part of investors that the so-called fundamentals may have already been discounted. The steel boom has gone stale as a market factor, and even the promise of big crops and a great increase of wealth to the country have not been sufficient to materially stimulate interest in investments.

A decision has just been given by the United States Circuit Court of Appeals for the Eighth District in a suit which has been in the courts for nine years. It favors the appellants in the case of Morgan Jones and others against the Missouri Edison Electric Company of St. Louis. Mr. Jones, who is a large stockholder in the Missouri Edison Electric Company, sought to have set aside and declared illegal a consolidation of the Missouri Edison Electric Company with the Union Electric Light & Power Company, both of St. Louis. He alleged that when a merger of the companies was effected in September, 1903, he and other stockholders constituting a minority were not allowed a proper amount of stock in the new company. The court holds, on the evidence submitted, that the distribution of stock in the new company to the holders of stock in the Missouri Edison Electric Company was unjust, and therefore the case is remanded to the lower court with instructions to find the valuation of the new company and assign the appellants the proportion of stock to which they are entitled, unless the defendants are willing to pay them the said value of the stock, with interest thereon, and the cost of the suit, within a reasonable length of time.

The Consolidated Cities Light, Power & Traction Company, the bonds and a large block of the stock of which recently was placed in Europe through Lloyd's Bank, London, has completed its organization by the election of directors. The board of the new corporation is composed of Henry L. Doherty, Frank W. Frueauff and Charles T. Brown, of Henry L. Doherty & Company; H. H. Scott, of the Doherty Operating Company; Warren W. Foster, of New York; Leslie M. Shaw, of Philadelphia; W. F. Hoffman, Columbus, Ohio; James Satterfield, Wilmington, Del.; Laurence McFarlane, Montreal, and James Mitchell, London, England, president of the Alabama Light, Traction & Power Company.

A deal has been closed by H. M. Byllesby & Company with the city of Louisville whereby the municipality disposes of its holdings of Louisville Gas Company stock, amounting to 9,250 shares. The price to be paid is that fixed by W. O. Head, mayor of Louisville, $150 a share. The Louisville Gas Company controls the Louisville Lighting Company, so that with the purchase of the municipal stock the Byllesby interests are in full control of the property. The city, by virtue of its holdings, has had four of the nine directors of the gas and lighting companies, and these will, of course, be retired and replaced with men selected by the new owners of the stock.

In order to complete the transaction the city of Louisville is putting into effect certain amendments in the charter of the gas company, by which the limit of indebtedness, $250,000, fixed in its charter is repealed. Provisions as to the number of shares of stock to be held by one individual, the issue of new stock, and other things conditioned upon municipal ownership of a large part of the stock are also to be eliminated. The ordinances providing for the charter amendments have been approved by the city council and the formal conclusion of the deal will be reached shortly.

A special meeting of stockholders of the General Electric Company has been called to be held August 29 for purpose of voting upon a proposition to increase the capital stock from $280,000,000 to $105,000,000. After such increase there will be paid to stockholders of record December 31, 1912, out of the surplus earnings of the company a dividend of $30 per share, payable in stock of the company at par. Such dividend is to recoup stockholders in part for dividends passed or reduced in period of years after 1893. For the future financial needs of the company it is proposed to issue debentures from time to time, and for this purpose the directors have authorized an issue of debentures limited to $60,000,000, bearing five-per-cent interest or less. For the special meeting at Schenectady, August 29, books close August 6, reopen August 30.

Dividends.

Detroit United Railway Company; a quarterly dividend of 1.75 per cent, payable September 2 to stock of record August 10.

General Electric Company; a stock dividend of thirty per cent, in addition to the regular two-per-cent quarterly disbursement.

Garton & Stonington Street Railway Company; a dividend of six per cent.

Lexington Power & Light Company; a preferred dividend of 1.75 per cent, payable August 1 to stock of record July 25.

Marconi Wireless Telegraph Company, Ltd.; a final dividend of ten per cent for 1911, on the preference shares and an interim dividend of seven per cent on the preference shares for 1921, payable August 1.

National Carbon Company; a regular quarterly dividend of 1.75 per cent on the preferred stock, payable August 15 to stock of record August 5.

Philadelphia Company; a regular semi-annual dividend of 2.5 per cent on the preferred stock, payable September 2 to stock of record August 10.

Sierra Pacific Electric Company; a quarterly dividend of $1.50 per share, payable August 1 to stock of record July 24.

Southern California Edison Company; a quarterly common dividend of $1.25 per share, payable August 15 to stock of record July 31.

Tampa Electric Company; a quarterly dividend of $2.50 per share, payable August 15 to stock of record August 1.

Kings County Electric Light & Power Company, regular quarterly dividend of 2 per cent, payable on September 3 to stockholders of record Aug. 21.

Reports of Earnings.

KINGS COUNTY LIGHT.

The combined earnings statement of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn show net earnings for June of $131,240, an increase of $4,131. The income account for June and for the six months ended June 30 compares as follows:

	1912.	Increase.
Gross operating revenue.	$ 398,860	$ 30,465
Oper. exp., taxes, etc...	267,620	26,334
Net oper. revenue.....	$ 131,240	$ 4,131
Non-operating revenue ..	3,141	*3,677
Total revenue	$ 134,381	$ 454
Bond discount written off	1,689	.....
Balance	$ 132,692	$ 454
Fixed charges	70,547	374
Surplus	$ 62,145	$ 80
From January 1 to June 30:		
Gross oper. revenue.....	$2,598,855	$291,526
Oper. exp., taxes, etc...	1,631,184	190,580
Net operating revenue.	$ 967,671	$100,946
Non-operating revenue..	25,672	*4,835
Total income	$ 993,343	$ 96,111
Bond discount written off	10,134	.....
Balance	$ 983,209	$ 96,111
Fixed charges	423,280	37,874
Surplus	$ 559,929	$ 58,237

*Decrease.

PEORIA LIGHT COMPANY.

The Peoria (Ill.) Light Company, controlled by the Union Railway, Gas & Electric Company, reports for the fiscal year ended December 31, 1911, as follows:

	1911	1910
Gross earnings.....	$1,030,475	$874,538
Net earnings	528,200	445,356
Net income.....	365,846	300,050
Surplus	290,168	250,050

The company owns all of the stocks of the Peoria Gas, Light & Power Company, the Citizens Gas & Electric Company, and the Washington Light & Power Company. Through these companies it does the entire gas, electric light, power and steam heating business in Peoria, Pekin, East Pekin, Peoria Heights, and Averyville, and the electric light and power business in Washington. The total population served is eighty thousand, without competition.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 29.	July 22.
Allis-Chalmers common (New York)	1¼	*1¼
Allis-Chalmers preferred (New York	4	1¼
American Tel. & Tel. (New York)	145¾	145¼
Commonwealth Edison (Chicago)	139	139
Edison Electric Illuminating (Boston)	295	295
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	55¼	55¼
Electric Storage Battery preferred (Philadelphia)	55¼	55¼
General Electric (New York)	182½	179½
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2	2¼
Massachusetts Electric common (Boston)	18½	19
Massachusetts Electric preferred (Boston)	*93	93
National Carbon common (Chicago)	117	*117
National Carbon preferred (Chicago)	119	118
New England Telephone (Boston)	153½	*151½
Philadelphia Electric (Philadelphia)	23⅞	21⅞
Postal Telegraph and Cables common (New York)	87	88
Postal Telegraph and Cables preferred (New York)	69¾	69¼
Western Union (New York)	81⅝	82¾
Westinghouse common (New York)	79½	76¾
Westinghouse preferred (New York)	122	120

*Last price quoted.

COMMONWEALTH POWER.

The Commonwealth Power, Railway & Light Company, controlling hydroelectric traction, lighting, power and gas properties in Michigan, reports for June, the six months ended June 30, and the twelve months ended June 30, as follows:

	1912	P. C. Increase
June gross	$ 483,418	11.74
June net	218,098	7.10
June net income	*60,473	*13.46
Balance after preferred dividends	*30,473	*23.59
Six months' gross	2,976,329	13.21
Six months' net	1,405,238	10.99
Six months' net income	524,942	3.88
Balance after preferred dividends	344,473	6.03
Twelve months' gross	5,866,884	11.18
Twelve months' net	2,771,422	9.95
Twelve months' net income	1,101,914	7.16
Balance after preferred dividends	741,914	11.02

*Decrease.

Balance for twelve months, after preferred dividends, is equivalent to 6.18 per cent on the $12,000,000 of common stock.

NIAGARA POWER.

The report of the Niagara Falls Power Company for the quarter ended June 30 shows net earnings of $496,079, an increase of $76,404. The income account, with changes, follows:

	1912	Changes
For quarter end. June 30:		
Gross earnings	$609,078	+ $62,127
Operating expenses	112,999	— 14,277
Net earnings	$496,079	+ $76,404
Other income	42,647	— 6,031
Total income	$538,726	+ $70,373
Charges	307,582	— 9,681
Surplus	$416,486	+$134,214
From Jan. 1 to June 30:		
Gross earnings	$1,220,863	+$122,610
Operating expenses	245,787	+ 3,540
Net earnings	$975,076	+$119,070
Other income	54,162	— 6,822
Total income	$1,029,238	+$112,248
Charges	612,752	— 21,966
Surplus	$416,486	+$134,214

AMERICAN GAS & ELECTRIC SUBSIDIARIES.

Earnings for June and twelve months ended June 30, of the Atlantic City (N. J.) Electric Co., the Muncie (Ind.) Electric Light Co., the Rockford (Ill.) Electric Co., the Scranton (Pa.) Electric Co., and the Wheeling (W. Va.) Electric Co., five of the subsidiaries of the American Gas & Electric Co., are reported as follows by the Electric Bond & Share Co.:

	1912	1911
ATLANTIC CITY ELECTRIC.		
June gross	$33,102	$33,717
June net	19,370	16,933
June surplus	10,843	9,207
Twelve months' gross	435,668	392,890
Twelve months' net	253,943	205,913
Twelve months' surplus	152,683	124,945
MUNCIE ELECTRIC LIGHT.		
June gross	$28,501	$20,005
June net	9,238	6,206
June surplus	2,787	587
Twelve months' gross	350,076	293,879
Twelve months' net	150,353	110,497
Twelve months' surplus	76,292	53,193
ROCKFORD ELECTRIC.		
June gross	$28,374	$26,356
June net	13,270	11,601
June surplus	5,455	4,112
Twelve months' gross	401,968	373,412
Twelve months' surplus	99,931	67,445
SCRANTON ELECTRIC.		
June gross	$55,891	$52,352
June net	28,151	25,501
June surplus	15,899	14,405
Twelve months' gross	765,228	703,720
Twelve months' net	433,573	396,520
Twelve months' surplus	290,402	269,649
WHEELING ELECTRIC.		
June gross	$18,272	$16,461
June net	8,670	7,239
June surplus	4,631	2,260
Twelve months' gross	242,696	183,427
Twelve months' net	121,544	98,456
Twelve months' surplus	76,079	81,155

PERSONAL MENTION.

A. H. BABCOCK, electrical engineer of the Southern Pacific's Alameda County electrification, has been given the title of consulting electrical engineer.

CLARENCE H. MACKAY, president of the Postal Telegraph-Cable Company, was a visitor to Chicago last week, and entertained a number of the managers of the Middle West territory.

KARL E. GUTHE, professor of physics at the University of Michigan, and well known for his research work in electrical measurements, has been made dean of the graduate department of the University.

J. H. HORNUNG has recently become manager of the San Francisco Division of the Great Western Power Company, in charge of all the property of the City Electric Company with the exception of the steam plant.

L. C. PORTER, of the Edison Lamp Works of the General Electric Company at Harrison, N. J., spent a portion of last week in Chicago conducting investigations on electric headlights used by railroads running into the city.

ROBERT E. HUGHES, president of the Kentucky Electric Company, of Louisville, is spending his vacation touring the Bluegrass region of Kentucky in a motor car. He is accompanied by members of his family.

CORNELIUS AMBRUSTER, of the construction department of the Electric Storage Battery Company, Philadelphia, was a visitor to Chicago this week. Mr. Ambruster is keeping in touch with recent installation work in the Middle West.

JAMES F. HAMILTON, general manager of the Schenectady Railway Company, Schenectady, N. Y., has been appointed acting general manager of the United Traction Company's lines, succeeding Edgar S. Fassett. Mr. Hamilton will fill both positions.

ALFRED MONTGOMERY, who has been in charge of the Clinton (Mass.) plant of the Massachusetts Lighting Companies, has assumed the managership of the Leominster (Mass.) Electric Light & Power Company, succeeding George B. Spring, resigned.

THOMAS J. McMANIS, of the Edison Lamp Works of the General Electric Company at Harrison, N. J., spent last week in Chicago collecting data on large installations of Edison incandescent lamps in that city. These data, which include illuminoneter tests and photographs, will be used in General Electric publications.

FREDERIC P. VOSE, the well known attorney of Chicago, Ill., was elected president of the Commercial Law League of America at its Colorado Springs convention last week. Mr. Vose is secretary of the National Electrical Credit Association, past president of the Electric Club of Chicago, a prominent member of the Sons of Jove, and well known to the entire electrical industry.

HERBERT B. BROOKS, of the National Bureau of Standards, has returned from an extensive trip to Europe covering about a year, during which he has particularly investigated the subject of electrical-instrument making for the Bureau of Manufactures. As a result of this trip one bulletin has already been published dealing with conditions in England and others will follow treating of the continental countries. Mr. Brooks will now resume charge of the Instrument-Testing Division of the Bureau of Standards.

ROY A. FIELD, who has been superintendent of the Rome, N. Y., Gas, Electric Light & Power Company, has been appointed general manager of the Kentucky Public Service Corporation, and has taken charge of his work. The company now owns gas and electric light plants in four Kentucky cities in addition to Clarksville, Tenn., and will spend $150,000 this year in making improvements. Consequently Mr. Field's work will be of an important nature. The Kentucky cities where he will be in charge are Hopkinsville, Owensboro, Frankfort and Bowling Green.

ALFRED STILL has recently been appointed chief electrical engineer to the mining department of the Algoma Steel Corporation. His headquarters will be at Magpie Mine, Ontario. The company Mr. Still is connected with is under the control of the Lake Superior Corporation of Sault Ste. Marie, Ont., and, apart from the complete electric power equipment at both the Helen and the Magpie mines, there is a hydroelectric power station now nearing completion, which will supply power to the mines over an 18-mile, three-phase transmission line. Mr. Still is an English engineer, well known as the author of standard books on electrical subjects and of frequent contributions of engineering articles to the technical journals. He is a member of the Institution of Electrical Engineers of Great Britain, an associate member of the Institution of Civil Engineers, and has recently been elected a member of the American Institute of Electrical Engineers.

ALEXANDER LESLIE BLACK has recently joined the firm of Ford, Bacon & Davis as engineer in charge of Southern properties. Mr. Black was born in New Orleans in 1871. He attended private schools in New Orleans and New York and was graduated from the School of Mines, Columbia College, in 1890. He engaged in mining work in the West and Mexico for three years, and was employed for a few months as assistant engineer on the Topographical Survey of New Orleans. In 1894-5 he had charge of the reconstruction for electric operation of the St. Charles Street Railroad Company in New Orleans, remaining with that company, supervising operation and constructing extensions for this company and other local companies until 1901, when the New Orleans properties were consolidated. Since then he has been engineer for the New Orleans Railway & Light Company and its predecessors controlling the New Orleans street railroads and lighting companies.

OBITUARY.

LAWRENCE T. PARRY, for fourteen years manager of *The World's* telegraph department, and one of the speediest telegraphers in the business, died suddenly on July 24 at his home in Elmhurst, N. Y.

RANSOM PHELPS, a veteran telegraph operator who took the first message announcing the surrender of Lee to Grant at the close of the Civil War, died at Crooked Lake, Minn., on July 20. His remains were cremated at St. Paul on July 22, and the ashes sent to Horton, N. Y., for interment.

DATES AHEAD.

Electrical Supply Jobber's Association, Niagara Falls, Canada, August 13-15.

Electrical Contractors' Association of Wisconsin. Annual meetings, Chain-of-Lakes, Wis., August 15-17.

Georgia Section, National Electric Light Association. Annual meeting, Tybee, Ga., August 15-17.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

American Electrotherapeutic Association. Richmond, Va., September 3-4.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Pennsylvania Electric Association. Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 4-6.

Eighth International Congress of Applied Chemistry. Washington, D. C., September 4, New York, N. Y., September 6-13.

American Electrochemical Society. Fall meeting in conjunction with Electrochemical Section of International Congress, New York, N. Y., September 7, 9 and 10.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 10-12.

Illuminating Engineering Society, Annual convention, Hotel Clifton, Niagara Falls, Ont., September 16-19.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 16-21.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10 and 11.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

Bridgeport Brass Company, Bridgeport, Conn., has sent out a folder showthe adaptability of Phono-Electric trolley wire for very severe service.

Diehl Manufacturing Company, Elizabethport, N. J., has issued bulletin No. 25, which describes and illustrates its 1912 line of electric ceiling and universal fans. It contains general specifications for direct-current ceiling fans. Bulletin No. 58 goes into the question of motors for individual operation of manufacturing sewing machines.

American Cyanamide Company, Niagara Falls, Ont., has let contracts involving the expenditure of about $500,000 for an extension to its plant which will more than double its capacity. The company uses the Frank & Caro process for the electrical fixation of atmospheric nitrogen. At present 6,000 electrical horsepower is required for operating the works.

Wagner Electric Manufacturing Company, St. Louis, has issued bulletin No. 99 describing its power transformer. This bulletin opens with an historical review of transformer development and then describes the construction of power transformers in considerable detail. These are made in sizes from 50 kilowatts upward and arranged for various methods of cooling. The bulletin is well illustrated.

National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., has issued several reprints of articles calling attention to the merits of its Eye-Comfort sytem of indirect illumination. One points out its marked advantages for the lighting of moving-picture theaters. Another gives some cost comparisons between this system and direct lighting which are favorable to the former.

Triumph Electric Company, Cincinnati, O., has issued bulletin No. 491 devoted to direct-current steel-frame motors. These machines have been designed to supply the demand for a strong, lightweight machine of high efficiency and low maintenance. They are built for 115, 230 and 500 volts. The bulletin describes the construction of these machines in detail and illustrates not only their parts but also a large number of typical installations, showing their general adaptability.

American Stoker Company, 11 Broadway New York City, has issued bulletin B-1, which is a 32-page catalog of the company's class "E" stokers. The construction of these stokers is described by the aid of many diagrams and half-tone illustrations. Typical installations are shown. Graphic curves are reproduced to show the economy achieved by using such stokers. The results of boiler tests are included and also considerable data of interest to the boiler-plant engineer.

Oshkosh Manufacturing Company, Oshkosh, Wis.—G. W. Schueppert, sales manager of this company, spent a few days in Chicago last week in the interests of his company. Mr. Schueppert states that this has been the best year in the history of the Oshkosh company and never was the demand for his product as large as it has been during 1912. Kalkeen insulator pins, made by this concern, seem to be in particular favor as, even though the company has worked day and night in turning out these pins, it has been unable to keep up with the demand.

Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1630 on hydraulic turbines with spiral-plate-steel casings. These machines are used with single and twin runners, and are especially suited for direct connection to electric generators. A large number of them have been installed in hydroelectric plants, several of which are described and illustrated in the bulletin. The bulletin also contains very comprshensive data on power and speed for various types of these turbines and describes their construction in detail.

The Morris Iron Company, Frederick, Md., has issued a series of designs of ornamental street-lighting standards adaptable for tungsten cluster lighting, inclosed arc and magnetite arc lighting and also for single tungsten systems. There are also shown some designs of combination trolley and cluster posts, several boulevard standards surmounted by a single globe and a number of ornamental brackets for series or multiple incandescent systems. These designs represent only a few of the company's products but give a fair idea of the graceful lines and harmonious effects that all of these designs possess.

Duplex Metals Company, Chester, Pa., has issued a new catalog devoted to Copper-Clad steel wire for telephone service. This 46-page book is extremely well illustrated. It gives an historical review of the development of bimetalic, hard-drawn, and finally of Copper-Clad wire. The process used in the production of the latter is described in some detail with the aid of numerous illustrations. The metallurgy of this wire is discussed and its physical constants and other data given. The bulletin also gives a discussion of the requirements for telephone transmission and for various types of telephone-wire service. There are also included valuable tables of interest to the telephone and telegraph engineer. Copy of this catalog will be sent on request to the company.

The Electrical Manufacturing Company, 1951 Lawrence Street, Denver, Colo., has placed on the market the Caine fireproof box support. This is a sheet-iron, adjustable bracket so arranged that the outer edge of the box will come flush with the finished surface, assuring the contractor that the cover of the box will not ride on the plaster, but make a smooth, dustproof contact with the box. The company is also marketing a new two-piece adjustable iron cabinet box for either open or concealed iron conduit or knob-and-tube wiring. This box is made with a telescope front so arranged that the box may be set into the plaster and the hinged front lined up so as to make a dustproof, tight contact between the front of the box and the hinged cover.

Bulletins describing these will be furnished upon request.

Allgemeine Elektricitäts Gesellschaft, Berlin, Germany, has organized a subsidiary company, with headquarters in Berlin and a principal branch in the City of Mexico, to take over the Mexican agency conducted for 14 years by Enrique Schoendube. The new company has been registered under the Mexican law as the A. E. G. Cia. Mexicana de Electricidad, S. A. It intends to push the business very vigorously in Mexico, Central America, and Cuba, and will go after big orders in the way of electric railway, tramway, power, and lighting undertakings of all descriptions. A competent staff of experienced engineers and erectors, trained in the head offices of the parent company, will be maintained in Mexico. The branch office in Mexico City will be under the direction of Friedrich von Blucher and Otto Rusche.

The Electric Appliance Company, Chicago, Ill., has ready for distribution a new bulletin devoted to the A.-W. regulator. This regulator, for maintaining constant current in series Mazda street lighting circuits is now built in both pole and station types. The pole type regulator requires no switchboard or instrument; requires no attention. It is simply installed on the pole and left to do its work. Lamps are turned on and off by a reliable high-tension time switch and an 8-day clock. Lamp outages are compensated for automatically and lamps and line are protected from surges or other abnormal circuit conditions. This regulator is of particular interest to central stations lighting outlying districts. The new bulletin is full of interesting information, including wiring diagrams and engineering data. Copies will be furnished to those interested upon request.

Record of Electrical Patents.

Issued by the United States Patent Office, July 23, 1912.

1,033,085 to 1,033,087. Differential Microphone Transmitter. J. J. Comer, assignor to Automatic Enunciator Co., Chicago, Ill. The first two patents describe different ways of mounting the differential microphone box. In the third patent one microphone is in front and another in back of the diaphragm.

1,033,095. Rotary Variable Condenser. H. Gernsback, New York, N. Y. Flexible sheets of paper and foil are wound on or unwound from the middle of three parallel drums.

1,033,098. Telephone Receiver. J. Halldow, assignor to Dean Electric Co., Elyria, O. Has a thin body shell with a cap connected thereto by threaded rings.

1,033,104. Suspension of Trolley Wires. M. Jellinek and J. F. de Tóváros, Budapest, Austria-Hungary. The wire is hung from a catenary messenger cable by means of hanger loops whose ends are secured to the messenger and middle points to the trolley ears.

1,033,114. Telephone Relay or Repeater. C. D. Morris, assignor of three-fifths to W. D. Junkin, Spokane, Wash., and one-fifth to J. B. Swinburne. In the middle of a heavy casing is a diaphragm beneath which are the receiving magnets and above which is the transmitter mechanism.

1,033,117. Starting Device for Electric Motors. M. F. Owens and A. T. Marshall, assignors to Automatic Refrigerating Company, Hartford, Conn. Includes automatic switches for having the starting circuit pass through heavy fuses only, then placing light fuses in series therewith for guarding the running current.

1,033,122. Electrically Heated Comb. E. Schwartz, assignor to Pelouze Manufacturing Co., Chicago, Ill. Has a heating element connected through the handle.

1,033,123. Fuse Device. E. O. Schweitzer and A. Herz, Chicago, Ill. Within a covered casing is a fuse with a spring-pressed fuse block.

1,033,126. Method of Producing Endothermic Compounds from their Components. W. Siebert, Rheinfelden, Baden, Germany. Nitric oxides are formed from air between electrodes in a circular electric furnace.

1,033,135. Telephone System. A. H. Weiss, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. Relates to the connection of different relays to the cord circuits for providing selective harmonic ringing.

1,033,152. Push-Button Switch. C. A. Clark, assignor to Trumbull Electric Manufacturing Co., Plainville, Conn. Includes a pivoted trigger and an oscillatory plate carrying a contact bar.

1,033,166. Trolley Base. C. E. Gierding, Newark, N. J. Has a yoke for resisting the upward swing of the trolley arm when the trolley suddenly jumps the wire.

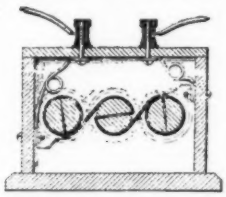
1,033,188. Dynamo-Electric Machine. C. C. Mitchell, assignor to Triumph Electric Co. Provides special means for accurately centering the rotor.

1,033,205. Electrode. E. C. Speiden, assignor to International Acheson Graphite Co., Niagara Falls, N. Y. A sectional graphite electrode made of flat plates abutting laterally to make a cruciform structure with staggered ends.

1,033,208. Rear Signal for Automobiles. A. B. Stites, Plainfield, N. J. Electric lamp signals controlled automatically by the steering rod.

1,033,221. Electric Motor. E. S. Wetmore, College Springs, Ia. The armature of an electromagnet operates a pawl that turns a ratchet wheel.

1,033,228. Dry Battery Cell. J. W. Brown, assignor to National Carbon Co., Cleveland, O. In the middle of the carbon is a metallic core to which the binding post is secured.



1,033,095.—Variable Condenser.

1,033,243. Controlling Apparatus for Railway Switches and Signals. H. W. Griffin, assignor to Union Switch & Signal Co., Swissvale, Pa. Electric signals are operated simultaneously by the switch-controlling lever.

1,033,253. Lantern for Vehicles. J. G. A. Kitchen, Lancaster, and I. H. Storey, Ambleside, England. A casing on the dashboard contains a number of electric lamps and reflectors individually controlled.

1,033,257. Application and Distribution of Electromotive Power for Use in Starting Machinery. G. W. Mascord, London, England. The operating lever consists of two co-operating parts, one governing the motor starter and the clutch, the other controlling the motor field.

1,033,262. Trolley-Mechanism-Controlled Switch. J. R. Nestor, Seattle, Wash. Reversal of the trolley pole reverses the switch for an indicator.

1,033,275. Connection for Running Incandescent Lamps and Arc Lamps in Common. W. Schäffer, Berlin, Germany. A set of series arcs are connected across one branch of an auto-transformer and the incandescents in parallel are connected across the other branch.

1,033,286. Electric Dumb-Waiter Control. M. Spahn and I. Concoff, Portland, Ore. Includes a rotary switch drum, brushes engaging it, a bifurcated rock frame rotated by the motor and a bell crank co-operating therewith on the switch shaft.

1,033,333. Trolley Wheel. W. E. Marshall, assignor to I. J. Scott, Danville, Ill. Has doubly rotating guard arms over the wheel.

1,033,335. Trolley Head. J. C. Mattison, Vancouver, B. C. Includes two sleeves yieldingly held together.

1,033,340. Electric Switch. S. Morris, assignor to Hart & Hegeman Manufacturing Co., Hartford, Conn. Relates to the spring and spindle construction.

1,033,341. Electric Danger-Alarm for Railroads. P. W. Mosher, Stockton, Cal. A sectional third rail and an auxiliary rail are used for the alarm circuits.

1,033,344 and 1,033,345. Trolley Wheel. H. Prack, Ottawa, Ill. The web of the wheel contains a series of rollers parallel to the axle; on these rollers runs the wire-engaging rim.

1,033,347. Electric Lamp. W. A. Richardson, assignor of one-half to J. G. Barrett and one-half to E. M. Kennealy, Chicago, Ill. Turning the lamp in its socket depresses and short-circuits the socket terminals, thus cutting the lamp out of circuit.

1,033,352. Metallurgical Product. W. Rübel, Berlin Germany. An iron for electrical purposes that is free from phosphorus, silicon and manganese, but contains not to exceed three per cent of copper.

1,033,357. Electrical System of Distribution. W. A. Turbayne, assignor to Gould Storage Battery Co. Includes a storage battery, a booster in series therewith, an exciter for the booster field and special control system for the exciter.

1,033,379. Dynamo-Electric Machine. J. Burke, assignor to Burke Electric Co., Erie, Pa. Provides a special method of keying the core laminations to the stator frame.

1,033,384. High-Voltage Protective

Device. N. J. Conrad and E. O. Schweitzer, Chicago, Ill. A fuse surrounded by a cork envelop is held under tension in a long casing containing an arc-extinguishing fluid.

1,033,393. Globe-Holder. W. S. Gibbard, Marysville, O., assignor to Standard Stamping Co. Has an expansible globe-holding ring with outwardly extending curved arms.

1,033,409. Apparatus for Measuring the Ratio of Two Electric Currents. L. Joly, assignor to J. Carpentier, Paris, France. The moving element has two coils carrying the two currents to be measured and moves from a neutral position in a nonuniform magnetic field.

1,033,427. Combined Socket-Cover and Shade-Holder. C. W. Lucas, assignor to Faries Manufacturing Co., Decatur, Ill. Has a cap fitting over the socket cap and to which is secured a removable skirt holding the globe at its lower edge.

1,033,435. Art of Electrotyping. M. A. McKee, assignor to C. B. Cottrell & Sons Co., New York, N. Y. Consists in first depositing copper onto the mold uniformly and subsequently depositing additional copper into the backs of the printing portions of the shell being formed.

1,033,449. Spark Plug. J. E. Murray, assignor to A. R. Mosler, New York, N. Y. Has two spark gaps, one on either side of a central barrier.

1,033,473. Electrical Make-and-Break Circuit Device. W. S. Ryan, assignor

1,033,427.—Socket-Covering Shade-Holder.

to L. Hengerer, New York, N. Y. A motor-driven contact shaft and brush mechanism.

1,033,474. Connections for Regulating the Speed of Alternating-Current Commutator Motors. M. Schenkel, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. A polyphase motor has two sets of adjustable brushes, one connected in series with the stator and the other direct with the secondary of the main transformer.

1,033,478. Cash Register. W. F. Schweiger, assignor to National Cash Register Co., Dayton, O. Includes an electrical indicator.

1,033,483. Globe-Holder. J. M. Spear, Washington, D. C., assignor to Standard Stamping Co. A modification of No. 1,033,393.

1,033,508. Apparatus for Controlling the Charge of Storage Batteries. J. L. Woodbridge, Philadelphia, Pa. An automatic switch disconnects the battery from charge after its voltage has remained stationary for a predetermined time.

1,033,509. System of Electrical Distribution. J. L. Woodbridge, Philadelphia, Pa. A storage battery is caused to discharge to help carry peak loads and to be charged in the valley part of the load curve.

1,033,519. Electric-Motor Drive Mechanism. C. P. Banzhof, assignor to B. G. Stauffer, C. F. Stauffer and L. W. Horting, Lancaster, Pa. A variable brake mechanism for speed control of a series motor.

1,033,529. Thermostatically Controlled Apparatus. M. J. Brierty, Chicago, Ill. A temperature-controlled electrically operated valve.

1,033,542. Electrically Operated Valve. G. W. Collin, assignor to Collin Valve Co., Portland, Me. A solenoid-operated pilot valve.

1,033,543. Electric Solenoid. G. W. Collin, assignor to Collin Valve Co. For operating a valve.

1,033,560. Lighting System for Vehicles. L. R. Duval, New York, N. Y., assignor of one-half to G. C. Gardiner and L. Knapp. Includes a dynamo, a storage battery, a regulator and automatic switches.

1,033,567. Driving Mechanism. E. A. Eustice and E. L. M. Eustice, Newton, Ia. A reversible gear mechanism for use on an electric washing machine.

1,033,579. Electric Rat Trap. J. Gresko, Benwood, W. Va. Includes electric contact plates in a trough and on a tiltable platform.

1,033,604. Art of Electrotyping. M. A. McKee, assignor to C. B. Cottrell & Sons Co., New York, N. Y. An additional amount of copper is electrodeposited on the back of the shell in the high printing portions.

1,033,619. Telephone Attachment. J. E. Ross, Springfield, Mo. An ear tube is attached to the receiver.

1,033,629. Method of and Apparatus for Amplifying Varying Electric Currents. L. W. Southgate, Worcester, Mass. Includes a polyphase inductor alternator and a selector.

1,033,725. Automatic Telephone Exchange. E. Neuhold, assignor to Deutsche Telephonwerke G. M. B. H., Berlin, Germany. Relates particularly to the test and release arrangements of the selector switches.

1,033,726. Electric Hair Comb. J. T. Niblett, Stockwell, and W. H. Cadman, London, England. In the body are located a magnet, armature, condenser and induction coil, whose relative movement induces electricity in the teeth.

1,033,754. Inclosed Electric Fuse. L. B. Buchanan, assignor to Chase-Shawmut Co., Newburyport, Mass. Has a transparent tube coated with lead acetate which is turned black on blowing of the fuse by having H_2S set free from the filler.

1,033,762. Electrode for Illuminating Purposes. I. Ladoff, Cleveland, O., assignor of three-tenths to W. D. Edmonds. An arc-light electrode consisting of compressed and partially fused ilmenite ore.

1,033,767. Bonding Rail Joint. J. G. Smith, assignor to F. E. Harder, Detroit, Mich. The fish plates are provided with special seats for the bonding wires.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 30, 1912:

543,490. Contrivance for Disinfecting Telephone Apparatus. R. Lamarche, Hamburg, Germany.

543,495. Electrical Controlling System for Elevators. C. O. Mailloux, New York, N. Y.

543,502. Electric Arc Lamp. S. E. Nutting, Chicago, Ill.

543,523. Starting or Stopping Device for Electric Motors. J. P. B. Fiske, Alliance, O.

543,524. Device for Automatically Operating Brakes and Rheostats. J. P. B. Fiske, Alliance, O.

543,525. Electric Motor and Brake Mechanism Therefor. J. P. B. Fiske, Alliance, O.

543,529. Electric Trolley. G. W. Hooper, Rochester, N. Y.

543,544. Electric Car Brake. G. B. Damon, Lowell, Mass.

543,557. Overhead Traveling Crane. T. R. Morgan, Alliance, O.

543,559. Signaling Apparatus for Telephone-Exchange Circuits. J. J. O'Connell, Chicago, Ill.

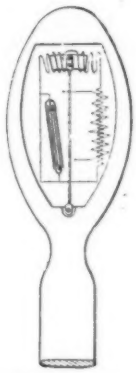
543,591. Railway Signaling System. T. B. Dixon, Henderson, Ky.

543,592. Electrical Railway Signaling System. T. B. Dixon, Henderson, Ky.

543,593. Register. T. B. Dixon, Henderson, Ky.

543,594, 543,595 and 543,596. Electrical Railway Signaling System. T. B. Dixon, Henderson, Ky.

543,597. Track Instrument. T. B. Dixon, Henderson, Ky.



1,033,726.—Electric Hair Comb.

543,625. Machine for Boring Joists for Electric Light Wiring. J. G. Henderson and R. H. Henderson, Chicago, Illinois.

543,626. Transmitting and Receiving Attachment for Telephones. H. W. Libbey, Boston, Mass.

543,653. Electric-Brake Shoe. W. B. Potter, Schenectady, N. Y.

543,654. Electric Soldering Iron. F. B. Rae, Detroit, Mich.

543,670. Four-Motor Reversing Switch. F. E. Case, Schenectady, N. Y.

543,680. Secondary Voltaic Battery. Epstein, London, Eng.

543,686. Thread Guide for Electrical Stop Motions. R. C. Holt, Troy, N. Y.

543,707. Electric Clock-Winding Mechanism. W. S. Scales, Everett, Mass.

543,708. Telephone Exchange. W. Y. Shibata, San Francisco, Cal.

543,729. Electric Arc Lamp. C. E. Harthan, Lynn, Mass.

543,785. Railway Signaling. J. G. Schreuder, Edgewood Park, Pa.

543,793. Switch and Signal Mechanism. J. V. Young, Boston, Mass.

543,798. Telephone. N. L. Burchill, Washington, D. C.

543,800. Electric Heating Rug. J. R. Davis, Parkersburg, W. Va.

543,824. Electrodeposition of Alloy. H. J. Altman, New York, N. Y.